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ABSTRACT

This publication reports findings of a 12-month study of progression opportunities in engineering education and training, a study which explored ways of bridging the gap between skills and knowledge acquired through basic training and prevocational education and those required for progression to higher levels of occupational training and vocational qualification. An introduction discusses methodology, background, and definitions. The following sections outline courses and schemes likely to be followed by a engineering student or trainee. Suggestions for bridging and for module content are made. The next section summarizes employer attitudes toward recruitment, schools, and schooling; college attitudes toward youth training schemes and the certificate of prevocational education; students' attitudes; and teachers' attitudes. Conclusions and recommendations are presented in five sections. The first focuses on the feasibility of the research model of bridging. The next section provides bridging outlines, which discuss the extent to which the different types of provisions could meet training requirements. The other three sections provide an overview of the conclusions, address cost implications, and make recommendations regarding module or course content, assessment and profiling, progression, and publicity. The instrument and additional data are appended. (YLB)

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University of Surrey
Department of Educational Studies

PROGRESSION INTO ENGINEERING

Building Bridges between Education, Training and Employment

Karen Evans, Jan Shepherd and Veda Doveston

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PREFACE

This volume reports the findings of a twelve month study of progression opportunities in engineering education and training.

The purpose of the study has been to explore ways of bridging the gap between skills and knowledge acquired through various forms of foundation training and pre-vocational education and those required for progression to higher levels of occupational training and vocational qualification.

The study originated from the need identified in the MSC 1984 Position statement on the Modernisation of Occupational Training

> `Foundation training under YTS and under the related educational initiatives should also provide young people with new opportunities for learning and doing and the chance to progress to further occupational or job specific training in a way that takes account of what they have already learnt. There is a need to assist transition between foundation training an appropriate occupational training opportunities, and NTI Objective 1 is concerned with the development of appropriate `bridges' and `ladders'!' (Para. 7).

The study builds upon research undertaken by the University of Surrey from November 1984 - June 1985, which reviewed and compared the training provision for recruits at first entry level across the industries represented by the 16 Training Boards and the Non Statutory Training Organisations. This research (reported in Evans K and Malcolm H 1985, Analysis of the curriculum in Foundation Training MSC/University of Surrey) highlighted the limited extent to which credit and exemptions against occupational training were available to young people who had followed foundation training schemes. The Manpower Services Commission, wishing to explore the potential for constructing `bridges and ladders' commissioned the University of Surrey to undertake a further feasibility study focussing on one major industry. The engineering industry was chosen for close attention as it represented an important employer of school leavers, and as it had an established system of foundation training regulated by the industry itself through the Engineering Industry Training Board (EITB).

This `feasibility' study began in November 1985, predating the `Review of Vocational Qualifications' produced in April 1986 under the Chairmanship of H.G. De Ville. While the outcomes of the RVQ could only be anticipated in the design and implementation of the study, the relevance of our work to the RVQ recommendations is obvious.

While our original brief was conceptualised in terms of bridging `modules' between different educational and training routes and employment, our conclusions aim to present ways in

which provision might be developed in order to minimise or remove gaps as well as identifying specific bridging mechanisms where significant gaps exist. In this way it is hoped that our study will contribute information of importance to the rationalisation process on which NCVQ has embarked. By taking engineering as a `Case Study' in progression, our study should also indicate some more general issues needing consideration in other occupational sectors.

The study has been an exercise in consultation and co-operation. Key contributors to the report are listed overleaf. It is a pleasure to acknowledge the assistance and willing co-operation given to us at all stages of the study, not only by those listed but by all who afforded us their time in interviews and visits. The staff of MSC and EITB have been particularly helpful and supportive throughout, and we thank them for their guidance. As Project Director, I wish to give special credit to my colleagues, Jan Shepherd and Veda Dovaston, who have worked with energy and commitment to meet a demanding project brief; to the Project Secretary Hilarie Hall for her part in the production of the manuscripts; and to Heather Malcolm of SCRE and Geoff Parkin of Willesden College of Technology, for their invaluable consultancy support.

The Report is divided into 2 parts:

Part I presents the current situation in engineering education and training, looked at in terms of provision, new directions and attitudes of the key parties. It highlights key issues in progression and draws detailed conclusions about the potential for establishing bridging mechanisims to facilitate progression from different forms of foundation training and prevocational education.

PART 2 examines progression issues with reference to `case studies' of engineering-related education, training and employment in 5 different geographical areas: Wirral, Poole, Berkshire, Bedfordshire and Scotland.

A summary document has been produced, and dissemination of findings will be assisted through a national conference to be held in July 1987 at the University of Surrey.

Karen Evans (Dr)
University of Surrey
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SUMMARY OF REPORT

(References to the relevant pages of Part 1 of the report are included in brackets within the Summary).

In this study, we have set out to explore ways of bridging the gap between skills and knowledge acquired within various types of pre-vocational education and foundation training (TVEI, CPVE and YTS programmes) and those required for progression to higher levels of occupational training and vocational qualification in the engineering industry.

The research was initially focussed on the feasibility of constructing bridging `modules' linking the different educational and training routes. However, account has also been taken of ways in which any gaps can more effectively be identified, minimised or removed.

The research has addressed a series of related and complex questions.

The first of these questions is that of basic description:-

> What are the characteristics of TVEI, CPVE, YTS General, YTS Engineering and Engineering Occupational Training in this context?

The second is:-

> Can TVEI, CPVE and YTS be defined in such a way that links with occupational training can be established?

Following on from this:-

> Can engineering-based modules be devised to bridge students or trainees into engineering?
>
> What alternative mechanisms might facilitate progression into the industry?

and

> How could the modules or mechanisms work in practice?

Finally consideration has to be given to more general contextual questions:-

> How do the attitudes of groups and individuals affect progression?

and

> What are the benefits of bridging to the industry and to the trainee?

WHAT ARE THE CHARACTERISTICS OF TVEI, CPVE, YTS GENERAL, YTS ENGINEERING AND OCCUPATIONAL TRAINING IN THIS CONTEXT?

Technical and Vocational Education Initiative (TVEI) (pp.35-37)

TVEI is essentially a funding mechanism and relates to an approach to teaching and learning. It is not a qualification in its own right, but leads to nationally recognised qualifications CSE, GCE and GCSE as well as those more commonly linked with vocational C&G and BTEC. The programme designed for 14-18 year olds promotes relevance in the curriculum to the `world of work' and encourages the development of skills and qualities which will be of direct value to students when they enter employment. Emphasis is also placed on progression through from school based courses onto the post 16 phase and onto vocational training and higher education.

For practical purposes within the research assumptions have had to be made about common and likely types of provision within TVEI relevant to engineering. It is appropriate, when considering bridging, to consider specific skills and core or general skills which may be directly relevant to engineering:

- most TVEI students who intend to enter engineering will have followed technology/engineering courses leading to CSE, GCE and GCSE in, for example, Craft, Design Technology (CDT), Technology, Design and Realisation and Electronics, and also C&G and BTEC which are more common in the post-16 phase. The more recently developed courses lay emphasis on design, the ability to communicate ideas and problem solving as well as aiming at raising awareness and interest in the industry as a whole.

- the TVEI `core' aims to develop the more general qualities of initiative motivation and enterprise, and encourages students to work as a member of a team and to gain information technology-related and general problem solving skills.

  Work Experience is an integral part of TVEI programmes and may provide direct experience of an engineering company.

Certificate of Pre-Vocational Education (CPVE) (pp.38-45)

CPVE is a flexible programme for students of 16+, which can be followed in schools or colleges and if taken full-time lasts for one year. It meets the needs of students who intend to enter full-time vocational education, training or employment but who are not yet firmly committed to vocational choice and may also want to retake and improve their performance in examinations taken pre-16.

CPVE allows students to:

- gain CPVE accreditation within a range of `core' areas including numeracy and comunication
- follow CSE, GCE, GCSE etc. courses to examination standards as required
- follow `taster' vocational courses which provide an introduction to various vocational areas
- pursue accredited vocationally-focussed courses including those leading to `CPVE preparatory module' certification
- experience work situations first hand through a work placement

In practice only a small proportion of CPVE courses nationally are as yet relevant directly to engineering. However, students who do follow engineering-focussed CPVE programmes are likely to take City and Guilds or BTEC units within it.

In a general sense, CPVE is itself a `bridging' course designed to meet the varying needs of students who may require, most commonly, additional CSE or GCE qualifications to gain entry to training or employment. It enables them to work for these and to follow parallel vocationally-focussed programmes at the same time. As a `taster' for the uncommitted student, it also informs choice and builds confidence.

Youth Training Schemes (YTS) (pp.30-32)

All school leavers of 16 have the option of two years of YTS vocational training. Schemes have to include a minimum of 20 weeks of off-the-job training, with the remaining time based in a work setting. (Some schemes include substantially more than the minimum off-the-job period - see, for example, 3 (below).

Three types of YTS scheme were identified as relevant to engineering:

1. YTS `General': schemes which include no engineering-focussed off-the-job components, but which may be based in an engineering work environment which enables some relevant skills or knowledge to be acquired.

2. YTS `Engineering': schemes which include an engineering-focussed off-the-job component plus work-based training in an engineering environment.

3. YTS `Apprenticeship style' training: schemes in which the trainee is employed by the organisation running the scheme and is following a programme very similar to that formerly used for full-time apprentices.

City and Guilds Engineering and Training Board-devised skills programmes are commonly used as a basis for 2 and 3.

Initial Occupational Training in Engineering (pp.18-29)

There are three recognised types of engineering training open to 16-19 year olds, each of which prepares trainees for different types of jobs within the industry. These are:

production operative training - which is often focussed on a limited set of job tasks requiring few formal academic attainments

craft training - which has a relatively formalised structure, and requires some - variable - formal academic attainments

technician training - which tends to be based in individualised programmes taking into account trainee backgrounds and specific job functions, with fairly rigorous selection

These three very different programmes all incorporate some `basic engineering elements' which may be covered either in depth or briefly, dependant on the trainee, the intended job

function and the organisation. Given the increasingly fluidity of engineering roles with the emergence of new technologies, it is particularly important to focus on the common elements of the programmes rather than the detailed programme requirements.

The `elements' which are commonly incorporated in all training at this level are:

1. an induction into the industry
2. an induction into the employing organisation
3. appropriate safety training
4. familiarity with tools, materials and machines
5. some basic practical engineering skills (eg. forming, welding)
6. familiarity with technical symbols and instruments
7. measurement skills

CAN TVEI, CPVE AND YTS BE DEFINED IN SUCH A WAY THAT LINKS WITH OCCUPATIONAL TRAINING CAN BE ESTABLISHED? (pp.85-132)

Students or trainees emerging from TVEI, CPVE and YTS programmes will have a range of different `credits', attainments and skills. Some of these are compatible with the types of activities undertaken within the industry and industrial training while some are simply connected and others appear to have no direct relevance.

Taking each of the `basic training elements', general judgements can be made of the extent to which the different types of provisions could meet training requirements.

1. An introduction into the industry:

   TVEI: most CDT or technology based courses and all engineering focussed City and Guilds or BTEC courses will provide this

   CPVE: any student who takes an introductory vocational module will have effectively had an induction to the industry

   YTS: (i) general - only informally, if at all
   (ii) engineering - during induction and normally in off-the-job training (though not if focussed strongly on Engineering Skills, as some programmes are).
   (iii) `Apprenticeship' - during induction and off-the-job training.

2. Introduction to the employing organisation:

   This may be provided within the work experience component of TVEI, CPVE and YTS. There is some evidence that work experience leads to employment offers in all three, though this is not its primary aim.

x

3. Safety:

Any practical work has safety implications, and it is assumed that relevant safety procedures are taught in all environments.

It is often noted, however, that safety regulations within schools and colleges do not have to conform to the same legal standards as those in industry.

All industrial training, whether within an industrial placement or in full employment, should of necessity include relevant safety training, even where the trainee can already display a knowledge of safe practices.

4. Familiarity with tools, machines and materials:

TVEI: all CDT technology and engineering focussed courses will include basic familiarity

CPVE: engineering-focussed students will have basic familiarity if they have done an exploratory module

YTS: General - possibly some familiarity
Engineering - should have full familiarity
`Apprenticeship' - should have full familiarity
as necessary

The extent of familiarity of TVEI and CPVE students in particular will vary. They may have a developed knowledge of uses and properties to a point where there is substantial overlap with operator, technician and even craft programmes.

5. Some basic practical engineering skills:

TVEI: all CDT, technology and engineering-focussed courses will include some practical skills

CPVE: engineering-focussed CPVE students will have some practical skills if they have done a relevant exploratory module or preparatory modules

YTS: General - in most cases, limited practical skills acquisition
Engineering - should be competent in a range of practical skills
`Apprenticeship' - should be competent in a range of practical skills as necessary.

6. Familiarity with technical symbols:

TVEI: students who have done CDT, technology, or engineering focussed courses should be familiar. Those who have done Design Drawing (which is now a central `core' of all GCSE Craft and Technology courses) will be fully competent up to and beyond the levels of even initial technician training.

CPVE: Engineering-focussed student who have done preparatory modules should be familiar

YTS: General - some basic familiarity, possibly
Engineering - should be familiar
`Apprenticeship' - should be familiar

7. Measurement skills

All trainees who have average or above average attainments in mathematics at school should have relevant measurement skills though they will not necessarily have experience of their industrial uses. (The ability to convert metric to imperial measurements is frequently quoted as an `industrial use' which it is particularly relevant for an engineering trainee to have due to variations in the design of engineering plant).

Mathematical attainments can also be displayed through the CPVE `core' certificate of attainment and within the YTS core.

Students who have completed: TVEI, CDT, technology or engineering focussed courses and CPVE engineering preparatory modules; can be expected to have a more developed appreciation of the industrial uses of mathematics than other students.

It is clear from the above list that there are many basic areas of compatibility between the programmes, despite differences in the delivery style of each.

CAN ENGINEERING-BASED MODULES BE DEVISED TO BRIDGE STUDENTS OR TRAINEES INTO ENGINEERING TRAINING?
WHAT ALTERNATIVE MECHANISMS MIGHT FACILITATE PROGRESSION?
(pp. 133-136)

Before engineering-based modules can be devised, previous relevant experience must be established.

This can be done in several ways:

1. informally, in interviews or discussions
2. using written summative profiles or records of achievements
3. using formal testing and assessment (may include practical skills tests)

1. Interviews - can establish the areas of relevant experience, knowledge and skills

2. Profiles and records of achievement - can record attainments either in detail (including standards of competence, such as engineering tolerance levels) or more broadly. Many such records or profiles are already used within TVEI, CPVE and YTS eg. the CPVE preparatory module checklists and many locally devised frameworks

3. Testing and assessment programmes - can be constructed using whatever training criteria are considered appropriate. Many practical engineering skills and testing mechanisms already exist eg. the EITB Craft Programme checklist. Information gained in interviews and profiles can help to focus more formal testing programmes of this sort.

If students/trainees all follow similar programmes to a similar level, efforts can be made to establish comparability between the programme content and subsequent provision.

Standardised top up modules can then be devised for groups of trainees with similar experiences to link with specific courses or programmes.

This might take place at a local or national level. At a local level efforts can be made to familiarise employers with local initiatives, so that they can adjust industrial training programmes to reflect them. At a national level, exemptions can be formalised between any programmes which

have wide currency in the industry. (This could be done following the introduction of any major new programme. An example is City and Guilds 201 which should have a consistent overlap pattern with many EITB Programmes though the full extent of overlap can only emerge over time).

HOW COULD THE MODULES OR MECHANISMS WORK IN PRACTICE?

When the type and extent of previous experience is established, different sorts of bridging modules or mechanisms may be appropriate. As all YTS Engineering, most TVEI and CPVE schemes and some YTS General schemes will include some relevant skills, experience and knowledge, the exact extent of which will vary from trainee to trainee, individualised modules or programmes may need to be constructed to `top up' trainees to the established training criteria.

In order to implement any formal progression mechanism, it is necessary to have:

1. Established training criteria

Some engineering programmes have clearly established training criteria, eg. craft training. Others eg. many operator and technician training programmes, are variable and often less formal. Where the training criteria of particular programmes are not standardised, bridging modules of the type outlined may either need to be highly individualised (eg. in technician training, where many programmes are already based on systematic detailed analyses of individuals' backgrounds and intended functions) or may not be appropriate (eg. in much operator training where job tasks are highly specific and previous experience not likely to be relevant).

However, the emergence of new technologies has made distinctions between operator, craft and technician functions less and less clear and has increased the number of new skill specialisms.

Given this fluidity, it may be more appropriate to look at bridges leading into the industry rather than into particular programmes, and more general criteria - based on the common elements of the initial training programme - could be used.

2. Effective profiling and/or initial diagnostic testing methods which reflect the criteria

Many systems already exist for profiling and recording achievements. However, at present there is little standardisation. To be useful for bridging purposes, summative profiles or records need to be easy to use and understand, to specify industrially-relevant levels of competence where appropriate, and to incorporate sufficient detail to inform further assessments.

Diagnostic testing systems need to be closely related to actual training criteria.

3. Resources and time to construct profiles and conduct assessments as necessary

4. The capacity to deliver individualised training

Training centres and staff need to be able to accommodate flexible individualised learning programmes.

Modules bridging trainees into specialist programmes would normally only be appropriate after recruitment to the programme and prior to initial training, in line with employer specifications.

Broad-based engineering programmes could however be provided within TVEI, CPVE or YTS schemes and also within initial training prior to specialisation. A programme which incorporates the basic `elements` described on page ix could be delivered in any of these contexts.

It could, for instance, be used as a module:

- within TVEI pre- or post-16
- as an introductory module within CPVE
- as an off-the-job YTS Engineering alternative
- as the broadly-based initial training component of industrial programmes to complement specialised skills training (especially relevant in many operator schemes).
- to top up students or trainees with little previous experience at any point.

Alternatively, the programme could be used to construct a set of baseline attainment levels which could measure skills and attainments, however gained. This would be particularly relevant within YTS and occupational training, where work-based learning is combined with opportunities for off-the-job learning.

HOW DO THE ATTITUDES OF GROUPS AND INDIVIDUALS AFFECT PROGRESSION?
(pp.63-85)

Attitudes amongst teachers and trainers in schools, colleges and industry are all changing to reflect new developments and changes.

TVEI has, for instance, raised the level of awareness of technology in many schools and encouraged the development of more design-oriented courses, and sometimes a more integrated approach to science and technology. Teachers see TVEI as providing a general preparation for engineering employment, however, rather than specific skills, which it was felt that employers have the resources, facilities and detailed

knowledge of their own requirements to do more effectively. Industrial trainers' views of TVEI reflect a very similar view: employers and trainers appear not to be universally in favour of a highly focussed vocational school curriculum for similar reasons. They feel that they can train individuals in specific skills more easily and effectively than schools can, but look to the schools to provide them with young people who will `fit into' the industry and the company, and who will have good communication and mathematical skills. Employers and trainers have varying views of the value of formal academic attainments, but an encouraging proportion of those who participated in the study had a broad familiarity with TVEI and were receptive to its general aims, which it was felt might meet some of their concerns about the quality of young recruits.

Students also valued the TVEI approach, and those who progressed into engineering frequently saw it as preparing them both indirectly and directly for their training.

Attitudes to CPVE are more difficult to gauge at this stage. Little CPVE in Engineering takes place in schools, and due to the timing of the research employers had no experience of the scheme when approached for their views. College staff and students, however, were enthusiastic about the framework and its aims, while expressing concern about its `credibility' in the employment world and its likely future: already there was concern that CPVE might be replaced by other courses within the next few years. Its strengths are seen as lying in its flexibility both to local employment needs and to students' requirements.

Attitudes to YTS are difficult to summarise, due to the many different schemes and local situations. Many employers see it as a way to fund training which overlaps substantially with their existing initial training. Managing agents outside industry (eg. in colleges) are often concerned with the placement of trainees, though regional differences in employment opportunities result in different concerns at this level. Managing agents of all types reflected an overall awareness that recruitment to engineering jobs had dramatically declined and that the jobs which were available were at an increasingly more skilled level. This it was felt made YTS training for those not employed by their work placement organisation (and many craft and operator jobs in the industry) less attractive to school leavers, with the result that the formal academic attainments of many YTS trainees were now lower than would formerly have been expected. There is also concern that some trainees are not fully committed to their vocational choice unless employed, and may not fully benefit from off-the-job work as a result.

WHAT ARE THE BENEFITS OF `BRIDGING' TO THE INDUSTRY (pp.4-11)

In terms of overall numbers of employees engineering is a declining industry in the UK. Many jobs have been lost, particularly in semi-skilled and unskilled areas, due to both mechanisation and external economic factors, and recruitment to traineeships in particular has declined dramatically: in 1971 almost 30,000 new craft and technician trainees were recruited to the industry compared to barely 10,000 (including YTS) in 1983. There are now fewer overall employees even in technician jobs than there were ten years ago, despite a dramatic increase in the proportion of technicians in the industry, reflecting a marked shift towards a more highly skilled engineering labour force.

In this climate, what are the benefits of bridging young people into the apparently dwindling number of jobs and traineeships available?

1. overall reductions in the number of engineering jobs has resulted in a very sharp decline in initial training and a partial exclusion of young people from the industry. Bridging would enable more young people with technical interests and aptitudes to enter the industry.

2. individual trainees avoid repeating work, gaining in motivation, and enabling a more rapid progression within the employing organisation.

3. as new initiatives such as CPVE, TVEI and YTS increasingly enable young people to gain engineering-relevant experience outside employment, the cost benefits incurred by reducing initial training time will significantly outweigh the cost of bridging and assessment.

4. as trainee numbers have reduced many specialist engineering training courses have ceased to be viable.

   If groups of trainees can start more specialist training from a common baseline, regardless of their previous experiences, the viability of many engineering training course can be maintained.

5. the marked overall increase in skill levels in the industry means that more total training is required (especially bearing in mind that increased mechanisation will probably require regular staff retraining as well as more sophisticated initial training). Given this increase, any move to avoid unnecessary duplication is to be particularly welcomed.

6. despite lower employment numbers in the industry as a whole, serious skill shortages occur on a regional basis. Often these result from the difficulties of planning staffing for future needs. A one or two year `training' gap between identifying and filling a vacancy can represent a major production hold up for an employer, so that any reduction in initial training time will be beneficial.

INTRODUCTION

The purpose of this study is, in broad terms, to establish whether there is a need for more formal arrangements which would enable young people to progress into higher levels of occupational training in engineering from specified pre-vocational courses and Youth Training Schemes.

The study was commissioned by the Manpower Services Commission (MSC) to contribute to its aim of facilitating the transition of young people into employment as expressed in 1981 in the first of its national objectives in the `New Training Initiative':

> "We must develop skill training including apprenticeship in such a way as to enable young people entering at different ages and with different educational attainments to acquire agreed standards of skill appropriate to the jobs available and to provide them with a basis for progression through further learning". (1)

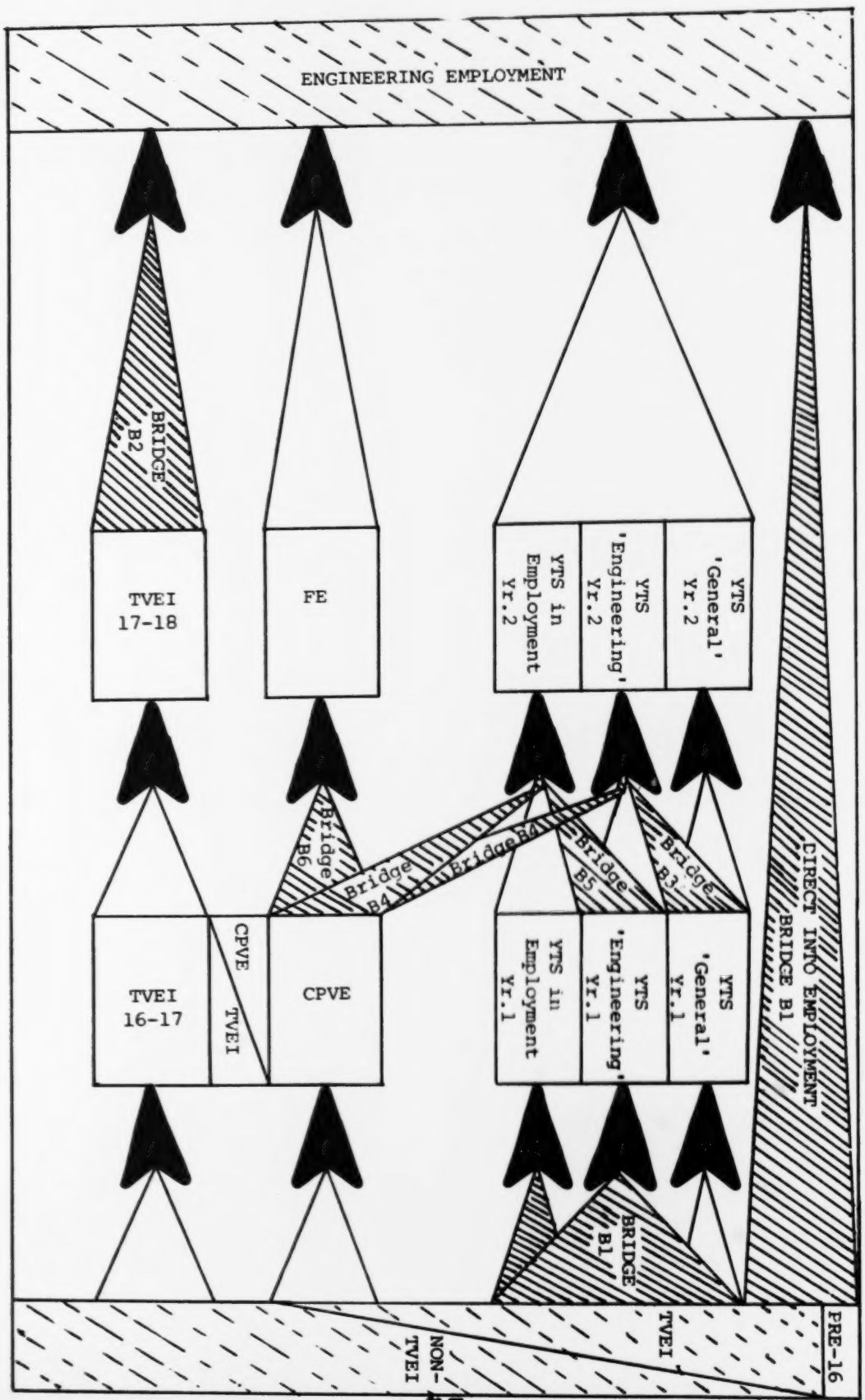
The study reflects a complex picture of change in which the establishment of new and more flexible routes into employment is an immediate priority. The recent White Paper `Working Together' summarises this concern:

> "Decisions at 16+ should not be irrevocable: bridges and ladders between the various routes to employment and to further and higher education will need to be built. Both the extension of TVEI and 2-year YTS should result in many more young people achieving vocational qualifications, and the same or similar qualifications may often be obtained through both these and other routes".(2)

The research team was asked to consider with reference to the engineering industry the possibilities of developing `bridging' modules which would build on skills acquired in TVEI, CPVE and YTS schemes to provide entry to industrially-based training and employment at different levels. (Fig. 1 gives an outline of the transition points identified as those where the construction of such bridges might be possible.)

In order to fulfill this research brief, it has first been necessary to establish the potential for bridging within the engineering industry and the providing agencies. This has involved a general and fairly wide-ranging review of arrangements and attitudes in engineering and engineering-related education and training. It has also been necessary to try to anticipate developments in all of these areas - a particularly important task in the light of the many recent changes which affect long-term plans and trends. The need to anticipate the likely interaction of so many different threads naturally means that the projections made are sometimes tentative.

Figure 1 PROGRESSION INTO ENGINEERING:
THE SIX 'BRIDGING' POINTS EXPLORED WITHIN THE RESEARCH



Having completed this review, the research team turned its attention to the potential curriculum and skill areas which `bridging' might cover. This has involved a detailed examination of the content of the developing programmes of education and training used by the organisations and providing agencies under study.

METHOD

The research started at the end of November 1985, and has been undertaken at three different `levels', intended to gauge:

1. scope and content of policy statements, syllabi and curriculum guidelines
2. general variations in implementation of courses and schemes
3. experience gained from attempts to coordinate schemes and construct progression routes at the local level

To explore these three levels data have been collected in different ways:

1. At policy level, discussions have been held with representatives of national bodies, and efforts made to acquire all the documentation produced by those bodies - whether in the form of Guidelines, reports, curricula, syllabuses, policy statements etc.

   Given the fluidity of the picture, it has been particularly important to keep in touch with the latest developments at national level, even when full implementation on the ground is likely to take several years.

2. In order to gauge how policy is implemented and the extent of variations in implementation, a selection of schemes and courses (in schools, colleges and training centres) have been visited, and structured interviews undertaken with key staff members and students/trainees.

   The schemes were chosen using `grapevine' methods- following discussions with the MSC regional and area offices; the training board; and individuals connected to the research area in various contexts. Every effort has been made to strike a balance between choosing typical schemes and schemes especially identified as illustrating `successful practice' though there has inevitably been some overlap between the two. In practice, the schemes looked at in industry have tended to be those operating in larger sized organisations: while the situation in smaller companies has been taken into account wherever and however possible, the tendency has been to restrict our research to those companies which are covered by the Training Board Levy Regulations.

Only a basic statistical analysis has been done of the responses gained in this way. In each of the centres visited and with each of the individuals spoken to, it has been important not only to gain precise details of how the scheme is put into practice, but also to gain impressions of perspectives and interpretations which affect the implementation. Each one has, to some extent, been seen as a case study in its own right.

3. In order to establish how local variables and considerations can affect practice, five case study areas were chosen for close attention. These were initially chosen as examples of areas where positive initiatives had been taken to effect progression into industry or where bridging had already occurred. In each area, attempts were made to interview individuals working in a number of related contexts - schools, careers services, engineering companies and companies employing engineering workers, training centres, local authorities etc. Where relevant, the structured interviews were used as a basis for discussions. However as the aim was to look at the factors which were peculiar to the area, as well as to the industry, the focussed questions in the structured interviews were not always relevant. By adopting a flexible interviewing strategy the researchers were able to gain different types of insights from the case study visits.

   Successful practice, which might serve as a model, could here be examined with reference to local factors. Also, the researchers could see how engineering-related training fitted into the pattern of educational and indusdtrial life in a `real' context, and how this might impinge on the potential for bridging.

Overall, an informal style was adopted, based on structured and unstructured interviews and observation of a wide range of practice.

BACKGROUND

In order to appreciate the considerations which have had to be weighed in establishing the need and potential for bridging modules, it may be helpful to give a brief summary of both recent and long-term developments which impinge on the review. The recency of many of them will highlight the extent to which the project has had to anticipate as well as reflect on the process of change.

The Engineering Industry : changes in recruitment and training

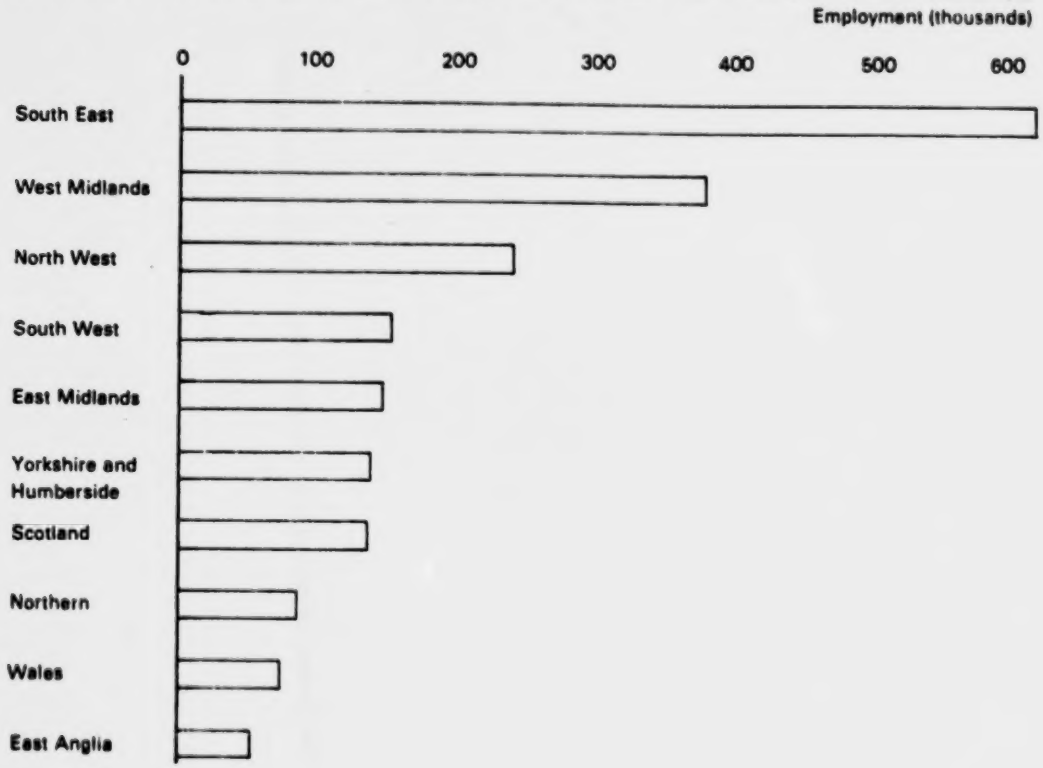
The backcloth to these changes has been the evolution of the engineering industry itself, which has undergone a number of upheavals compounded by and to some extent resulting from changes in skill requirements.

The engineering industry has been a major employer of school leavers and graduates throughout this century, (3) and its training system, largely based in the past on formal time-serving apprenticeships, has represented one of the more systematic approaches to industrial training.

Its time-serving apprenticeships originally arose within `heavy' manufacturing industry. Shipbuilding, steel production, car manufacture, all had a recognised need for a continuous and large supply of labour with certain specific skills, anticipating relatively stable employment conditions and skill needs. This type of industry, and the training style it adopted, tended to be concentrated in certain geographical areas such as the English North East and Midlands, and parts of Scotland and South Wales.

Recently these industries and the industrial life of the areas they dominated have suffered a decline resulting in unemployment and a reduction in the demand for engineering skills. Shipbuilding is a classic example of a once major industry which has declined as a result of national and international market trends, causing unemployment in most of the major coastal engineering centres. Elsewhere, however, and in other parts of the industry, reductions in the labour force and changes in skill needs have been caused by other factors - most importantly by increasing mechanisation and the introduction of computerised systems, robotics and other technological developments, which have made the industry less labour intensive.

Employment by region in the engineering industry, 1984



From: KHAMIS, C., LAWSON, G. and McGUIRE, S. (1985) Sector Profile: the Engineering Industry: Trends in its Manpower and training. Watford: EITB

Overall, engineering employment had declined by 1984 in all regions of Britain to between 58 per cent and 78 per cent of even 1978 levels, with the Southern parts of England least affected.

The numbers in employment have also fallen in this period in all the main sectors of engineering though least in the newer, technologically-based industries, aerospace and electronics. The greatest fall is in the motor vehicles and parts sector. The numbers of people in training what is more, for all occupations has fallen faster than employment and the pattern of engineering training has been adapted at all levels to accommodate the need for a more technical, more versatile labour force. (5) The traditional forms of apprenticeship training, and especially craft training- which focusses more heavily on the specific skills required to operate the basic manual machine tools (milling, turning, grinding and so on) - have all declined dramatically. Meanwhile the demand for technicians who can maintain and use

technologically sophisticated machinery has increased. (Despite an absolute decline in the number of technicians employed in the industry between 1978 and 1984 of 12%, technicians now represent a larger proportion of the engineering workforce than ever before). The emerging trend is for employers to recruit technicians who can adapt to technical innovation and retrain for new skills as necessary. As a result the criteria for selection to many technician programmes are becoming more stringent, and many employers are having difficulty recruiting appropriate staff.

Despite dramatic overall reductions in recruitment to the industry, therefore, significant skill shortages are reported in some areas, and at some skill levels. As these will be the areas which school or college leavers are likely to be entering, some consideration will be given here to the nature of these shortages.

Skill Shortages in Engineering

Engineering skill shortages are by no means new, although they have recently been highlighted by the demands of new technology. As far back as 1971, the Training Award Scheme represented an attempt by the engineering training board to train for local companies' needs in response to anticipated skill shortages. The scheme, which was discontinued in 1983, trained unemployed young people in engineering skills after referral by the Careers Service, and attempted to match their training specialisms to local requirements so that vacancies could be met quickly without the need for the employer to sponsor long term initial training.

Recent trends show shortages to be most severe at graduate level; somewhat less severe but increasingly serious at technician level; and, in some geographical areas, increasingly significant at craft and operator level too. (7) All shortages are reported as most serious in the South East of England, where comparative affluence and other social factors are often quoted as inhibiting recruitment (the low social status attached to careers in engineering is one such factor; and parental and school pressures for academically able students to extend their education is another which particularly affects the type of young person for whom technician training may be an option at 16 or 17).

Skill shortages at one level are also affected by recruitment patterns at other levels, given the policy in many organisations of promoting staff internally. For example, craft-trained workers have often been seen as a potential pool from which technicians can be recruited. The decline in craft recruitment combined with the more demanding requirements for technicians has meant that a higher proportion of technicians have to be trained from scratch. The recent NEDC/MSC report, Competence and Competition drew attention to this general trend, recommending that:

> `As a result of the decline in apprenticeship, new training routes for young people have to be developed by industry. This would enable the UK to avoid future skill shortages amongst competent craft and middle level people whose career paths traditionally began in craft apprenticeship' (Recommendation 8, p.7) (8).

Particular shortages are reported at technician level in certain skill areas. Test engineers, maintenance staff and fault finding staff with a knowledge of electronic applications are in demand nationally, while in the South East there is also a marked shortage of technicians to maintain CNC production machinery. At craft level, where the shortages are nationally less apparent, unfilled vacancies nonetheless exist for: machinists in mechanical engineering and metal products industries; turners; millers; sheet metal workers; welders; grinders and toolmakers. (See Appendix 3 for a fuller discussion of skill shortages).

A further related factor concerns the types of recruit which employers are able to attract. Where skill shortages exist, employers may find themselves taking on staff with fewer qualifications and in some cases appointing applicants who would previously have been seen as unsuitable. (9) In mechanical engineering, some employers attribute difficulties in recruiting higher attaining school leavers to the poor image of the industry, as the mechanical side tends to be seen as representing a passing technology in which jobs will become scarcer and scarcer. For further discussion of these and related issues see p. 63, and the section on `Attitudes'. (Some relevant statistics relating to the industry and employment and training within it are included at the end of this report in Appendix 3. The EITB has been particularly helpful in making many of these available).

Educational and Training Initiatives

A number of attempts have been made nationally to address the education and training issues which arise from these changes - and similar changes in other industries.

Pre-vocational and vocational initiatives have been heavily funded and promoted. On the pre-vocational side, the Technical and Vocational Education Initiative (TVEI) and the Certificate of Pre-vocational Education (CPVE) have become established features of the system in England and Wales. The main development in vocational training for 16-18 year olds has been the introduction of the Youth Training Scheme (YTS) in 1983, which at first provided for one year of training for school leavers and from 1986 set out to provide a guaranteed two years of training for sixteen-year olds. Less well known than the specific initiatives for 14-19s are the more general trends and developments which have taken place in initial technology education in schools. There has been a continuing move from courses in specific areas, for example woodwork, metalwork and technical drawing, to more broadly-based technology courses incorporating a range of skills. This has, in the most part, been the schools' response to the change to new technology which is occurring in the industry itself.

In line with the DES recommendations, on the `Curriculum 5-16'(10) there has been the extension of technology to 11-14 year olds in order to give all pupils in secondary schools the opportunity to sample a variety of crafts and technologies before deciding on their courses at 14. The new orientation of many technology related courses has been fuller consolidated by the introduction of the new GCSE syllabus. The foundation upon which prevocational and vocational studies build has also, therefore, been subject to change.

While the system of vocational education and training has strengths of diversity, responsiveness and credibility, concerns about the lack of a clear pattern of provision and shortcomings in the areas of access, progression and transfer led, in 1985, to the setting up of a Working Party to undertake the Review of Vocational Qualifications (RVQ). The task of the review was to recommend a structure of vocational qualifications in England and Wales which is:

- relevant to the need of people with a wide range of abilities
- comprehensible to users
- easy of access
- recognises competence and capability in the application of knowledge and skill
- provides opportunities for progression
- allows for the certification of education, training and work experience within an integrated programme.

The review resulted in the recommendation that a national body - the National Council for Vocational Qualifications (NCVQ) be set up to develop a coherent system of vocational qualifications in England, Wales and Northern Ireland.

While arrangements in Northern Ireland are closely aligned with those in England and Wales, the position in Scotland is significantly different. The Scottish system is more centralised and does not have the same proliferation of vocational exam bodies to contend with. According to the Review document, Scotland was excluded from the remit of RVQ (11).

> `because of the progress they had already made through the 16+ Action Plan in rationalising and reforming Vocational qualifications, and by the merger of,`SCOTBEC and SCOTEC to form SCOTVEC' (RVQ, 10.2).

A new framework for all non-advanced further education (NAFE) qualifications in Scotland has been introduced between 1984 and 1986. The framework is based on 40-hour modules drawn together into flexible programmes of study. The National Certificate, which credits students'cumulative performance, is awarded by SCOTVEC. The introduction of the National Certificate, alongside the extended YTS and TVEI provision has created a different pattern of `bridges and ladders'.

Our principal task has been to explore bridges into engineering from YTS, CPVE and TVEI within the context of patterns of provision available in England and Wales. However, the Scottish development held interest and possible lessons. In view of this, and of the stated aim of the Government to secure mutual recognition of equivalent vocational qualifications in England and Wales and Scotland, our work has included a study of the Scottish System. (This special study appears in the Case Study document).

The introduction of TVEI, CPVE and YTS and the establishment of the NCVQ, representing between them a major shift towards a more structured vocational education and training system have all taken place within the span of four years.

Furthermore, each is undergoing change and evolution within itself; 1986 was a significant year for TVEI, CPVE, YTS and the NCVQ. Within TVEI, it saw the announcement of plans to introduce national funding to cover every state school in 1987; for CPVE, it represented the first year of the non-pilot scheme; and for YTS, the first year of the two-year scheme. The Review of Vocational Qualifications reported and recommended the establishment of the NCVQ in 1986, shortly after our study was launched.

At the time of writing - early 1987 - it is not possible to guage what the full implications of these initiatives are, or indeed to judge their effectiveness. In tackling our task, therefore, we have taken the situation as we find it, and have tried to take into account the different ways in which it might develop.

In the next section we turn our attention to the courses and schemes which might be pursued by a student or trainee with an interest in engineering as a possible career, in order to establish a basis for analysis and comparison of possible pathways.

DEFINITIONS

Central to this report are the terms "Technology" and "Engineering", whose intepretation by those in the field of education, training and employment must be addressed. The two words encompass a range of activities and processes, and there is a great degree of overlap between technology and engineering. This research has attempted to take into account the variety of application of both terms.

It is therefore helpful initially to consider the dictionary definitions:

Engineering:
`the application of scientific principles into action or theory into practice'

An Engineer:
`one who creates, designs or invents'

`one who creates, operates and maintains efficient systems, structures, machines, plant processes and devices of practical and economic value'

Technology:
`that form of cultural activity devoted to the production or transformation of material objects or to the creation of procedural systems in order to expand the realm of human possibility'

`the systematic application of knowledge to practical tasks'

`tools in a general sense, including the organisation of knowledge for practical purposes'.

In reaching decisions about these definitions, some rules of thumb have been adopted. `Engineering' has been taken as covering:

(a) all industries which are `in scope' to the Engineering Industry Training Board (ie. manufacturing engineering including mechanical, electrical, electronic and instrument engineering, the manufacture of motor vehicles, aerospace equipment and of non-ferrous metals) plus shipbuilding industries.

(b) those activities within industries other than the above (those out of scope to the EITB) which require the use of engineering skills in maintaining and servicing production equipment, excluding the servicing and maintenance of motor vehicles.

Within these industries, the range of occupations (and the range of training available) is very broad. The main types of training currently offered to trainees of 16-19 within organisations in scope to the Training Board are described on pp. 18 - 29. Similar programmes exist in shipbuilding and the training of maintenance staff in other industries is frequently based on those parts of the Training Board's programme which are relevant to the skills and activities required. However, these programmes are based on assumptions about the distinct types of engineering employment. In particular, four types of employment are often identified- production operator; craft-based; technician and technician engineer.

These terms are not easy to define, as in practice many skills are shared by individuals who are technically in different job `categories' (in terms of job title, style of training etc). The introduction of `new' technology has further merged the roles of functions of engineering workers, also so that, for example, the employee who operates a CNC lathe may be using craft skills and judgement, but acting as an operator in relation to the machine itself, and overlapping with the technician in adapting and even designing the programme. However, despite this merging and changing of roles, we have made use of the conventional distinctions. The definitions adopted here are:

Production Operator - covers a variety of experience-ranging from narrow experience of one particular process to a more detailed knowledge of a complex series of activities.

Craftsman - has broadbased training in the manual skills commonly required in engineering, but will also have specialist knowledge and experience of one or more skills eg. milling or welding.

Technician - has broad knowledge of engineering techniques and procedures and an appreciation of their application in a range of situations.

Technician Engineer - has an extensive range of technical knowledge and must have the ability to apply these over a wide range of activities.

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TECHNOLOGY AND ENGINEERING 14-18

The sections which follow give a basic outline of the courses and schemes relevant to, and likely to be followed by, a student or trainee with an interest in joining the engineering industry. The chart included at the end of the section supplements these outlines. All suggestions for bridging and for possible module content are based on an analysis of what the courses and schemes in this section involve, and on the context in which they operate.

INITIAL INDUSTRIAL TRAINING : PRACTICE AND ISSUES

The engineering industry has a long tradition of formalised initial training for school leavers, and there are accepted guidelines on the basic patterns of training which have industry-wide currency. This section briefly describes these guidelines, and considers how they are operated in different contexts.

Provision varies in practice from highly structured apprenticeships to schemes in which the engineering content is almost incidental, with many programmes incorporating some but not all of the nationally recognised training elements (see footnote*).

Much initial training is based to one degree or another on the industry's own national guidelines, which are coordinated and monitored by the Engineering Industry Training Board (EITB). The EITB produces a set of training programmes and checklists for use in all the main branches of engineering, leading to EITB accreditation. These are the basis of all approved apprenticeship training schemes and are recommended for use within Youth Training Schemes (YTS). (As they have a central place in initial occupational training in the industry they are described below in some detail).

Where EITB programmes are not used, the alternatives take various forms - full-time City and Guilds, BTEC or locally-designed courses were all encountered during the research. At the lower skill levels in particular, there is a tendency for training to be company-devised, and it is estimated that in operator training, for instance, only 15% of schemes conform to EITB recommendations. At more advanced skill levels, company-devised training is frequently submitted to the training board for approval as equivalent to one of their established programmes.

EITB programmes are commonly run within the Youth Training Scheme, and no sharp distinction can be made in practice between schemes which are approved under the Youth Training Scheme and those which are not, as there are substantial areas of overlap. However, some training practices are only encountered within YTS, such as those described under `YTS General' and `YTS Engineering' on pp. 31-2. Where YTS provision follows the EITB/MSC approved model, or provides an

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* The descriptions of the different types of initial training provided within the industry, have drawn on data from over 30 representative schemes from across England and Wales. In each scheme, whether run in a company, training centre or college, details of basic training content were obtained using the structured interviews in Appendix 2, usually backed up by documentation; in many, training methods were also observed in practice within the workshop.

equivalent level of professional training, employers frequently offer exactly the same training and terms to new recruits within YTS as they do outside it - including a contract of employment and full salary on an age-related scale. The chief difference lies in the financial benefits to the employer of aligning the scheme with MSC requirements. For this reason, more and more initial training programmes are being subsumed within YTS, so that the number of exclusively company-funded apprenticeship places - which was already at its lowest for several years in 1983 (1) when YTS was introduced - has declined even more sharply since its introduction.

Nonetheless, numerous schemes fall outside YTS - for various reasons. In some cases, employers simply prefer to offer company-funded training even where their schemes would be broadly compatible with YTS criteria; in others, the scheme framework is incompatible with YTS criteria - operator training programmes for instance are sometimes too focussed on specific job content to satisfy YTS criteria.

However, it is not unusual for a company which runs training outside YTS to run YTS schemes for non-employee-status trainees alongside their employee programmes, so that apprenticeship, YTS and job-specific training frequently take place in the same centre or workshop. This 'mixed economy' means that training space and heavily-resourced workshops are used to the full despite the diminishing number of apprenticeships.

Engineering Industry Training Board (EITB) Programmes

Much of the training within the Engineering industry is done in accordance with EITB Programmes, normally combined with either City and Guilds or BTEC courses.

When the training boards were established - in 1964 - the Board's role was essentially concerned with apprenticeship trainihg, and one of the purposes of its formal training programme was to ensure that youngsters received a broadly-based engineering training during their first years, and only specialised when they had a thorough grounding in the range of basic skills. This principle runs through the EITB programmes for craftsmen/women and technicians in particular, both of which incorporate basic skills in the early part of the structured programme, usually off-the-job full-time in a training centre.

Apprenticeship programmes had always been seen as lasting for a fixed span of years, with each part of the training taking a pre-defined amount of time to complete. The training was therefore based on time-serving, with guaranteed craft or technician status granted at the end of the agreed time (normally four years for craft apprentices) regardless of the standard to which the skills are achieved.

However, there was some concern that this system made it difficult to regulate the standard of training within the industry as a whole. This applied particularly within craft training, where the skills are less specific to individual companies and organisations, and have industry-wide currency. In 1978, therefore, the EITB developed and trialled a new set of standards-based craft programmes intended to ensure that each trainee who acquired certification had achieved stated levels of competence in a minimum number of skills. (2) This system provided for trainees to acquire qualified status within a shorter period if they were particularly able.

In practice, however, the standards-based programmes have co-existed with time-serving procedures, and it is not unusual for the discrete `Parts' of the programme to be seen as representing a certain number of weeks' or years' activities.

Certain generalisations are often made about the likely time that it will take to complete particular components of the programme for practical reasons, and many centres will be concerned, for example, if an individual trainee takes significantly longer than average to reach the set standards, with unease also sometimes expressed that trainees who progress through the programme very quickly may not practice and reinforce the skills learnt, gaining too superficial a grasp of each one.

Many centres do in practice continue to express the training targets in terms of what they see as achievable within, say, a year in the workshop (a tendency which may in part be related to the fact that YTS programmes are designed around time blocks). (3) In á craft apprenticeship programme, for instance, a trainee may complete EITB Parts 1-4 to recognised standards and move on to module segment (more specialised) training within the first year, but it is often assumed that the completion of the initial Parts of training takes a calendar year.

The programmes described below are based on the sets of skills necessary to do specific jobs within the industry. At craft and technician level, they are also designed so that the initial period concentrates on assessment, induction and basic skills training and education; while subsequently more job-specific skills are developed. (4) The first part of the programme is normally conducted away from the work situation in craft programmes, either in the organisation's own training centre, in a group training centre (which might cater for the training needs of a number of large or small organisations on a contract basis), or in an EITB training centre, (which may be based in a college or elsewhere). After the trainee has acquired basic skills, however, much of the remaining specialised training is done in-company, usually with only the remaining day- or block-release City and Guilds or BTEC work done off-the-job. This part of the training is based on EITB-approved training modules and

segments (see footnote*) followed by periods of 'controlled experience' in which the specialised skills can be practised in a production environment.

1. Production Operatives Scheme

The basic components of an operative scheme are seen as:

i. two weeks of off-the-job induction training in: health and safety; fire procedures; first aid; communication; engineering drawing; measuring and marking out; materials; computer and information technology.

ii. basic training in anything up to four areas of competence such as: machining; bench-fitting and assembly; sheet metal work and welding; electronic wiring and assembly.

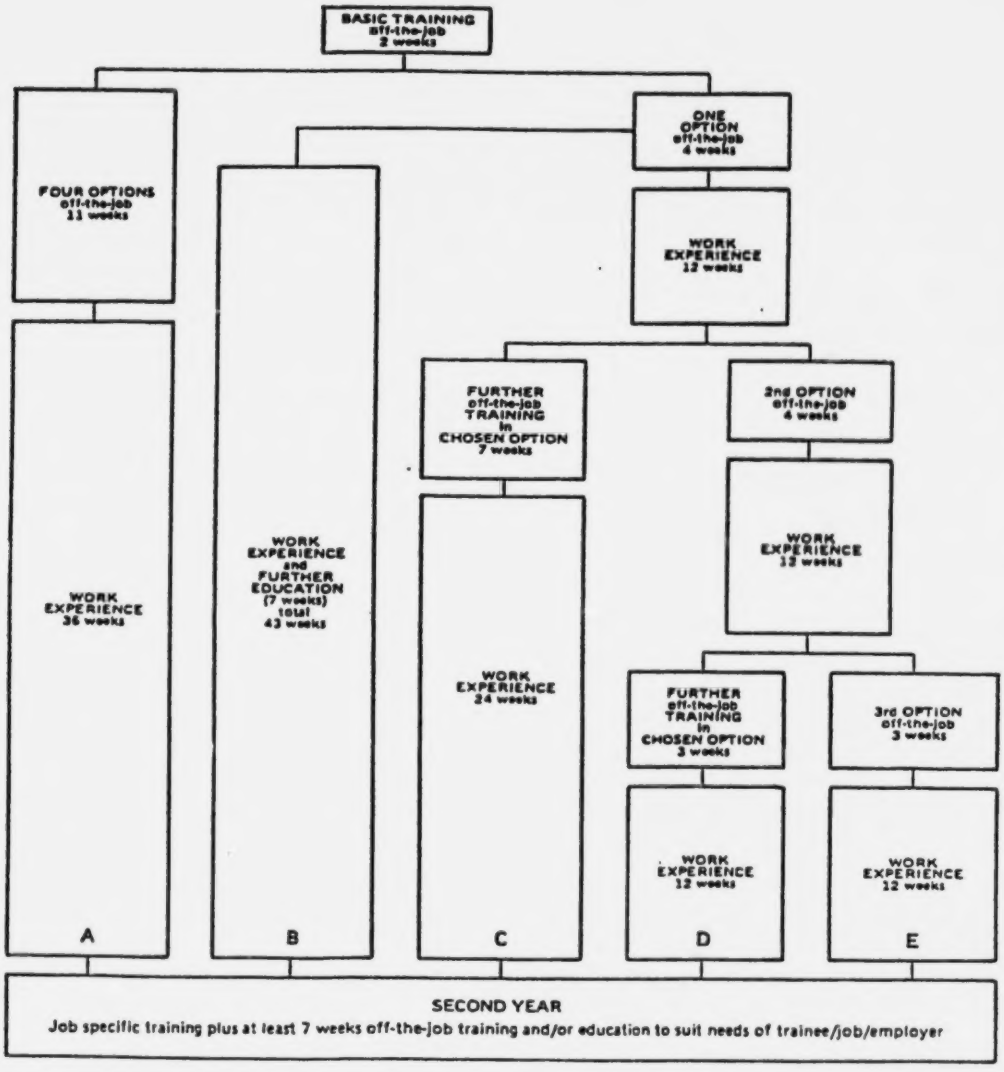
iii. work experience

iv. optional Further Education (such as City and Guilds 201).

(See Figure 1, which illustrates the alternative structures of production operative training recommended for use in YTS. (5))

* Segments are blocks of specialised job-related skills which are grouped together within particular skill areas to form modules of related training activity.

Figure 1



EXAMPLES

A. — Training in all four occupational options
B. — Training in one occupational option, plus further education
C. — Training in one occupational option, plus further off-the-job training in chosen option
D. — Training in two occupational options plus further off-the-job training in the option chosen
E. — Training in three occupational options

NOTE: Further education may be offered as an additional provision in year 1 for A, C, D and E.

Source: EITB/MSC YTS Illustrative Model Scheme for Engineering Production Operatives

2. Craft Schemes

The basic components of the craft scheme are:

i. induction training as above

ii. broad-based foundation training - normally taking up to 16 weeks - for all craft occupations.

iii. basic skills training in a range of specialisms within one of the five areas of: machining and mechanical skills; fabrication and welding skills; maintenance skills; electrical and electronic skills; engineering woodworking and pattern making.

iv. appropriate Further Education (such as City and Guilds, BTEC or SCOTVEC).

v. `segments and modules' of specialised job skills + `controlled experience' in production environment + FE.

(Figure 2 outlines the basic structure of craft training; and Figure 3 shows an example of an EITB craft programme as recommended for use in YTS. (6))

Figure 2

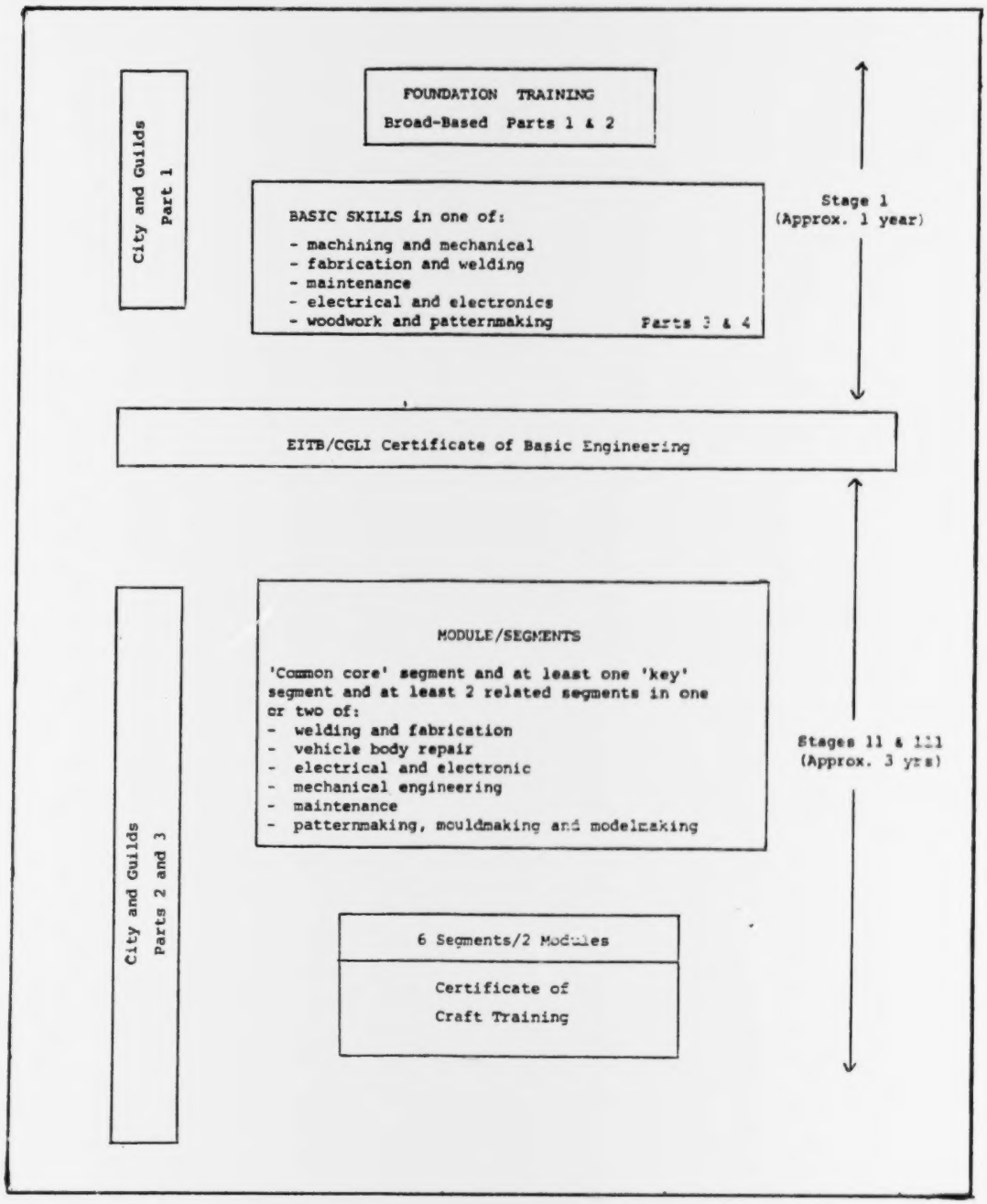
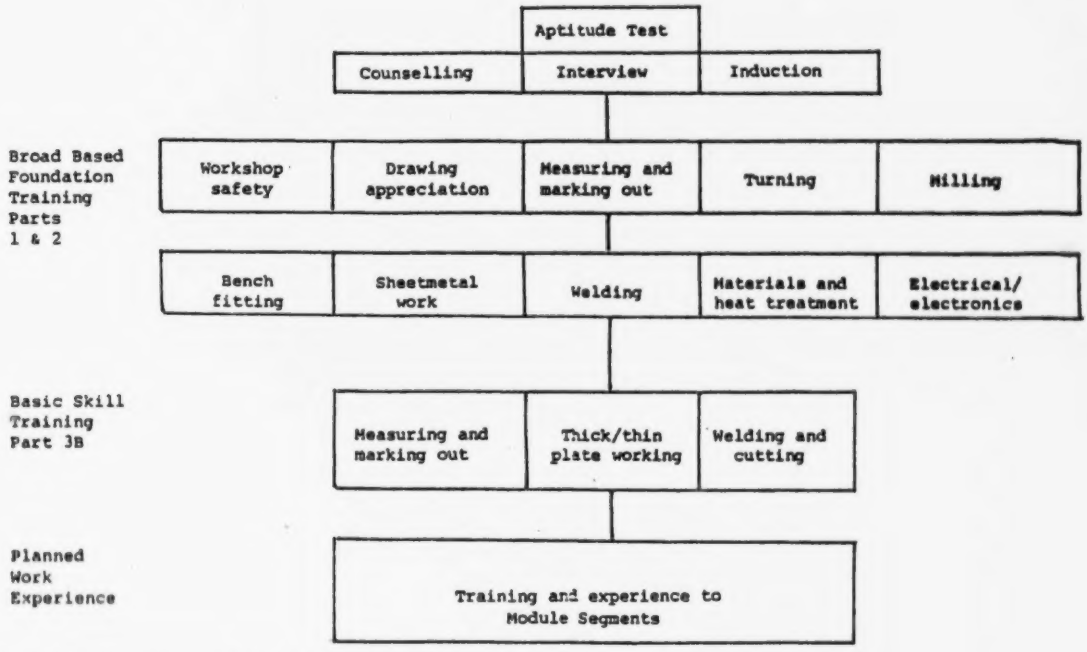

City and Guilds
Part 1
FOUNDATION TRAINING
Broad-Based Parts 1 & 2
BASIC SKILLS in one of:
- machining and mechanical
- fabrication and welding
- maintenance
- electrical and electronics
- woodwork and patternmaking
Parts 3 & 4
Stage 1
(Approx. 1 year)
EITB/CGLI Certificate of Basic Engineering
City and Guilds
Parts 2 and 3
MODULE/SEGMENTS
'Common core' segment and at least one 'key' segment and at least 2 related segments in one or two of:
- welding and fabrication
- vehicle body repair
- electrical and electronic
- mechanical engineering
- maintenance
- patternmaking, mouldmaking and modelmaking
Stages II & III
(Approx. 3 yrs)
6 Segments/2 Modules
Certificate of
Craft Training

Figure 3

Welding and Fabrication

YEAR 1



Source: EITB/MSC Illustrative Model Scheme for Welding and Fabrication Craft Skills

(FIGURE 3 Continued)

WELDING AND FABRICATION

YEAR 2

COMMON CORE SKILLS WELDING AND FABRICATION ENGINEERING PRACTICES	Safety Standards and Procedures Engineering drawings, specifications and practices Marking and Measuring Surface Preparation Tack Welding

SHEET METAL TECHNIQUES	WELDING TECHNIQUES USING MANUAL METAL-ARC
Marking and Measuring Producing holes Marking out and template making Material handling Metal cutting	Operation of equipment Fillet and Butt welding Welding inspection

3. Technician and Technician Engineer Schemes

Technician and technician engineer training is more variable than craft training, and focusses on acquiring knowledge about the employing organisation as well as about specific engineering functions and skills. Set periods of training in each department within the employing organistion are an integral part of the programme, which is normally combined with fairly advanced Further Education work consisting of BTEC units or SCOTVEC modules.

The basic outline structure is:

industry and company induction
off-the-job basic training
in-company general training in: the appreciation of design principles; manufacturing practice; commercial matters; control techniques
objective training, consisting of preparation for employment in a specific work area.

The training time will normally be more variable than for craft jobs, and the programme will be different for each trainee - in particular, some parts of Basic Training and all of the General Training are optional for technicians, though compulsory for technician engineers.(7)

(For the basic recommended outline, however, see Figure 4.)

Figure 4

		Technician Engineer	*Technician*
Induction Training	As appropriate at various stages of training	Essential	Essential
Basic Training	General Engineering Appreciation	Essential	Optional
	Selected Engineering Applications	Essential	Essential
General Training	Appreciation of Design Principles	Essential	Optional
	Manufacturing Practice	Essential	Optional
	Commercial Matters	Essential	Optional
	Control Techniques	Essential	Optional
Objective Training	Preparation to perform a specific job	Essential	Essential
Further Education	Successful completion of a course of study leading to a qualification of a standard at least equivalent to that of a BTEC/ SCOTVEC certificate.		Essential
	Successful completion of a course of study leading to a qualification of a standard at least equivalent to that of a BTEC/SCOTVEC higher certificate.	Essential	Optional

Source: The Training of Technicians in Engineering (TR21)

Exemptions within EITB Training

EITB policy is that all trainees entering initial training should be tested on entry to the training centre and that skills already acquired should be taken into consideration when individual programmes are put together. This policy is fully outlined in `Developments in engineering training: a paper for discussion' (IP67).

Certain specific courses may also lead to exemptions being granted from parts of the EITB programme. City and Guilds courses taken prior to entry can, for instance, exempt a trainee from the first `Part' of EITB training, which may reduce the training time by more than 10 weeks of training, and exemptions may be granted in isolated instances for other relevant work, undertaken within courses such as TVEI, CPVE and, in due course, GCSE.

However, flexibility is inhibited by the difficulties of implementation, and in practice exemptions are variable. There are four main reasons, specifically:

i. companies, unions and training centres continue to see training as time-based rather than standards-based, so that 98% of trainees still take a the `usual' four years to complete their apprenticeship.

ii. Industrial agreements have until recently been based on the `wage for age' incremental system, which assumes recruitment at 16 and salary increases staggered over the four year period until full craft or technician status is acquired at 20. A 1986 national agreement has however related earnings in the initial period of training to the achievement of training standards (though salary levels remain tied to length of service thereafter).

iii. training centres tend to structure the first year of their training around a 46 week period, and use this as the basis of their agreement with employers. Trainees who do progress more quickly are often given extra activities to fill the allocated time for organisational and financial reasons. Reductions in training time would in practice mean that the centres' incomes would be reduced, as the companies' fees are based on the length of time that the trainee is at the centre, and this is a strong incentive to retain traditional patterns.

iv. The necessity to account for training activities within YTS in terms of time taken encourages managing agents and their trainers to adopt pre-set schedules for all trainees, sometimes despite the standards-based nature of their programme.

The Youth Training Scheme (YTS)

The Youth Training Scheme was launched by the MSC in 1982, introduced in 1983, and was designed to provide `a permanent bridge between school and work'. The scheme aimed to fulfill the urgent need for occupationally and technically qualified young workers and to produce a better motivated and more adaptable workforce capable of developing skills to meet changing employment needs.

Over the last decade there have been a number of programmes with similar aims. The Job Creation Programme of 1975 was the first state-run employment scheme since the Second World War, and was introduced in response to the enormous rise in school-leaver unemployment: between 1972 and 1977 school leaver unemployment rose by 120 per cent, compared with a rise of 45 per cent in the working population as a whole. The same problem was addressed after 1977 by the Youth Opportunities Programme (YOP), and in 1983 by the introduction of the Youth Training Scheme which at first offered one year of integrated training and work experience to 16 year olds, and from 1986 offered two years.

The YTS scheme programmes for individual trainees are organised by managing agents (or, from 1987, Approved Training Organisations), which may or may not provide some of the training themselves, but which have the responsibility of supporting, guiding and reviewing the trainee's progress throughout the programme.

The most basic criteria (8) under which all schemes operate are:

1. that at least twenty weeks must be spent in `off-the-job' training (normally thirteen weeks in the first year and seven in the second).

2. that each programme should incorporate opportunities for trainees to develop the four YTS outcomes: competence in a job and/or a range of occupational skills; competence in a range of transferable core skills; ability to transfer skills and knowledge to new situations; personal effectiveness.

Within these broad guidelines, there is inevitably great variation in programme design and in organisation. Some of the main types of organisational differences are these:

1. In some schemes (`single site' schemes)(9) the managing agent is also the employer providing the work experience; while in others (`umbrella' schemes)(9) the managing agent (which can be a private agency; a consortium of companies; a chamber of commerce; local authority or FE college) organises work placements in a group of companies.

2. Some managing agents will recruit trainees as employees (particularly in 'single site' schemes), in which case the 'off-the-job' training will often be extended to well above the minimum. Others may take trainees on to the staff during or after YTS, using the scheme as an informal assessment period. Others will offer no prospect of employment at all.

In practice, the Youth Training Scheme encompasses a very broad range of training activities within any given industry.

Youth Training Schemes in Engineering

In order to explore the range of Youth Training Scheme provision in the industry, the researchers drew on the data collected in a wide range training schemes and centres, and present here a summary of the main types of provision encountered. In practice, however, the schemes selected for close examination tended to be a) those in which there were YTS groups rather than isolated trainees; and b) those in which engineering was a primary, rather than an incidental, focus. However, examples of all types of scheme were included and taken into account wherever possible.

Three broad types of scheme prepare young people for careers in engineering:

1. YTS 'General'
This encompasses schemes in which the main focus is not necessarily engineering, but which may include (most commonly) work experience in an engineering company.

There may be a number of engineering-related outcomes, including:

- specific skills, largely acquired on-the-job, such as the ability to operate machinery and perform tasks to a level of competence (sometimes compatible with basic skill specifications.)

- knowledge of the engineering environment, which may be gained while acquiring job skills in other areas, for example in clerical and stock handling departments.

- basic competences such as computer knowledge and numeracy which are essential to many engineering tasks.

Due to wide variations in work experience placements, engineering competences may be acquired superficially or in depth. Generalisations about the programme content are difficult to make even within one company without reference to individual examples.

2. YTS `Engineering'

This encompasses a wide range of schemes in which the main focus is engineering, and where the 20 weeks off-the-job element is based on a formal programme of engineering activities such as, most commonly, the EITB basic skills, City and Guilds or BTEC units of study. Trainees will normally be preparing for operator or craft jobs, and will not have employed status when recruited to the course. Work experience will normally take up most of the YTS training period, and will take place either in different company departments or on project work (in `single site' schemes) or in a range of different companies (in `umbrella' schemes). Companies in `umbrella' schemes in particular may use this type of scheme to assess a trainee whom they intend to employ during or after training.

3. YTS `Apprenticeship' Schemes

This encompasses schemes in which trainees have employee status from the time of recuitment. They normally follow the EITB/MSC recommendation on scheme design, and in practice there is usually little difference (to the trainee) between a company-funded apprenticeship and a YTS traineeship of this type.

Most YTS technician training is of this type, as recruitment is necessarily selective and training is specialised and company-specific. In skill shortage areas however in particular, companies may feel the need to offer trainees at all levels the additional security it implies - a practice which will also often fit in more neatly with established union agreements.

Initial Occupational Training - Overview

The two recognised programmes of training - for craft and technician trainees - are very different in emphasis, and within their basic frameworks provide for a wide range of variation. The third major type of training - for production operative jobs - is in practice even more variable, as only some schemes conform to established recognised training patterns. All these are also increasingly being adapted both at national and local level to accommodate the introduction of new technologies. Computer-controlled machines and systems have reduced the distinctions between operator, craft and technician jobs and as individuals find it necessary to extend their skills, they may find themselves working at different times at all three `levels' within the same job.

Given this increasingly fluid picture, and the likelihood that most of the individuals now entering engineering (and indeed many other vocational areas) will need to change or adapt to new skill requirements during their working lives (see the recent FEU bulletin `Supporting Vocational Change`), it is particularly important to focus on the common training elements rather than on the details of any one type of training.

All types of recognised programmes (ie. those which incorporate a broadly-based training element) include to some degree the following components:

1. An induction into the industry
   - describing the nature, role and distinctive types of engineering activities.

2. An induction into the employing organisation
   - relating the industrial perspective to the specific activities in which the organisation is engaged.

3. Appropriate safety training
   - including safety procedures necessary within an engineering environment as well as for the specific activities on which the trainee will be engaged.

4. Familiarity with tools, machines and materials
   - regardless of specialisation, this should include basic knowledge of the functions and characteristics of the equipment and materials commonly used within the industry. It does not necessarily include the development of competence in related skills.

5. Some basic practical engineering skills
   - familiarity with materials and their characteristics is best developed through basic practical skills, such as forming and welding, in which trainees are normally expected to attain given levels of competence.

6. Familiarity with technical symbols and the development of technical communication skills
   - the ability to interpret those graphical symbols which are commonly used within the industry and to use them appropriately in communication.

7. Measurement skills
   - the ability to translate basic mathematical and measurement skills into practice in an engineering context.

THE TECHNICAL AND VOCATIONAL EDUCATION INITIATIVE (TVEI)

The Technical and Vocational Education Initiative (TVEI), which aims `to stimulate the provision of technical and vocational education for 14-18 year olds' was launched by the Manpower Services Commission in 1982.

The scheme has been piloted in most education authorities in England, Scotland and Wales: the first 14 projects began in September 1983, with a further 48 in 1984, 12 more in 1985, and 20 more in Autumn 1986. By 1987 95% of education authorities will have joined the scheme. The extension of TVEI to cover all secondary schools in the state sector was announced in July 1986. Contracts are drawn up and agreed between the MSC and local education authorities incorporating details of how the broad aims and criteria laid down by the MSC are to be interpreted within the local context.

TVEI is a developmental project intended to introduce a new emphasis and direction into 14-18 curriculum in schools and colleges. Its aims reflect those expressed in the Government White Paper `Better Schools' (10) `More rapid technological change in an increasingly technological world places a premium on enterprise [and] personal versatility.'

The authorities are required to "explore and test ways of organising and managing the education of young people of 14-18 years across the ability range" so that the curriculum is more relevant to the world of work and that young people are better equipped to enter employment. Emphasis is placed on developing initiative, motivation and enterprise as well as problem solving skills and `learning by doing' within experiential learning situations. TVEI is seen as a bridge between education and work, in which young people have the opportunity to learn about and experience the working environment and it has particularly aided the development of courses in technology. Schemes are developed locally and respond to the local situation, resulting in a great variety of TVEI schemes within which a wide range of courses is offered, many of which have nationally recognised accreditation through the examining bodies.

One model of a TVEI programme, which is found in a number of education authorities, consists of a core including personal and social development, careers guidance and information technology, and a range of options including technology, business studies and catering, computing and electronics. This usually takes up approximately 30% of the students' time - the remainder being the `normal' school curriculum.

In the area of technology and engineering, the TVEI Database at Trent Polytechnic lists over a hundred courses, with a range of titles including Craft Design Technology, Modular Technology, Design and Production, Engineering Workshop Theory and Practice, Control Technology, Electronics, and Manufacturing Technology. Many of these courses have been

especially developed and validated for TVEI by national examining bodies. (Prior to TVEI Craft Design and Technology Departments in schools had already been moving away from the more traditional courses in for example woodwork and metalwork to more broadly based courses providing students with experience of different materials and technologies, and emphasising design.)

To support curriculum development in technology, each TVEI scheme has devised inservice training courses for teachers, in an attempt to stimulate teachers to develop the new teaching styles and also to provide teachers of other disciplines with the skills to teach technology - thus going some way towards meeting the teacher shortage in this area. Courses run by the British School Technology have, amongst others, provided a valuable resource for TVEI schemes in this field.

The TVEI scheme states in its criteria that:

> `Equal opportunities should be available to young people of both sexes and they should normally be educated together on courses within each project. Care should be taken to avoid sex stereotyping'.

This statement has particularly had an effect in the Technology Departments of schools running TVEI courses (also reflecting previous gradual changes in this traditionally male preserve, with the development of courses to provide all pupils with an experience of technology in the first years in the secondary school).TVEI and other national initiatives, for example Women into Science and Engineering and courses run for girls by the EITB have all been working towards promoting engineering for girls.

It is only now as the majority of TVEI schemes are reaching the 16+ phase that their effects are becoming evident. Students have a number of options at this point when compulsory education ends: - continuing the TVEI course in a school or 6th form college, entering a college of Further Education, joining a YTS scheme or entering employment.

At this early stage, the numbers of students taking different options is not yet clear, and thus it is not possible to assess the long-term effects a course in engineering or technology has on a career in engineering.

The need for industry to take an active part in the school curriculum has been clearly recognised in The "Better Schools" (10).

> `Industry and commerce are among the school's main customers. They have a vital role in raising standards at school by explaining their needs to the education service and by taking part in the development of its policies and activities'.

Industry has often been invited to become closely involved in the development of TVEI - by participating, for example, in curriculum development through work experience programmes, in developing profiles and by involvement in classroom activities. Although nationally there is varying response from industry, enthusiasm is often expressed by those companies who are involved. It is felt however that wider publicity would greatly aid employers' understanding of TVEI: many companies who in recruitment specifically value the qualities developed within TVEI courses are totally unaware of TVEI.

However, TVEI is not seen as offering a premature vocational specification: John Woolhouse, Director of the TVEI Unit, when recently discussing the criteria associated with the extension and the relationship between TVEI and specialised training, referred to the White Paper`Working Together'(11) `...relevance should not be sought through premature vocational specialisation'.

Under the TVEI extension, courses will not only be available to pupils in all age groups within the participating schools, but will also extend to cover a wider curriculum area.

Finally, the development of courses in TVEI has highlighted the shortage of suitably qualified technology teachers, and concern has been expressed about the pressures that the extension of TVEI will place on resources and particularly teachers in shortage areas. Suggested solutions hinge on pooling of facilities and sharing of skills and experience through for example the use of teaching teams, further inservice training, peripatetic and trained supply teachers and centralised resource centres.

THE CERTIFICATE OF PRE-VOCATIONAL EDUCATION (CPVE)

The Certificate of Pre-Vocational Education is a national qualification available to young people who have taken a course approved by the CPVE Joint Board after the end of compulsory schooling. It can be offered in schools, colleges or in consortia (which usually consist of several schools and one local college) and programmes are locally designed, and normally take up to one year of full-time study. There are no specific entry criteria. The course is intended primarily for those who are not vocationally committed, and one of its main aims is to give experience of the world of work in such a way that students can make informed decisions about their future careers. Once a career decision has been taken, the student can take `vocational' modules within CPVE which will in some cases give formal exemption into further education courses such as those run by City and Guilds and BTEC.

Vocational Studies

The vocational work must be combined in some way with a `core' of activities which ensure that students can develop competences up to a certain level in ten specific areas- this core consists of: personal and career development; industrial, social and environmentdal studies; comunications; social skills; numeracy; science and technology; information technology; creative development; practical skills and problem solving.

Vocational modules can be taken at three levels- introductory, exploratory or preparatory - and the student progresses from one level to the next as he or she becomes more vocationally committed; students progress at their own rate, so that some may not do any preparatory work, but may concentrate instead on exploring possible vocational choices within the introductory and exploratory modules.

The vocational modules within the programme can be locally devised or can be based on nationally accredited courses such as those provided by City and Guilds and BTEC. The Joint Board has also itself produced a set of CPVE preparatory module outlines, which would lead into accredited vocational programmes.

Vocational studies are normally taken within specific occupational categories, and most of the students with an interest in or embarking on an engineering career would take exploratory and preparatory modules within the Technical Services and Production categories. Exploratory modules would provide a basic introduction to engineering - a `taster' on which to base decisions, and would involve some form of project work. Preparatory modules would be at a more advanced level, enabling the student to develop specific skills and knowledge.

Certain qualifications acquired within CPVE vocational work

would enable a student to get exemptions from parts of full-time further education courses. Examples might include: Level 1 BTEC Units in Mathematics; Physical Science; Engineering Drawing and Workshop Processes (which together constitute a `core' of units within BTEC Engineering Certificate and Diploma courses) or in micro-electronic systems; Information Technology or Motor Vehicle Maintenance. Students in some instances may cover similar ground to that covered by full-time first year BTEC students, so that the route into BTEC Level 11 courses or BTEC National is clearly mapped out. Similarly, City and Guilds courses taken within CPVE - such as Basic Engineering Competences (City and Guilds 201) - progress automatically into City and Guilds Level 11.

The Joint Board CPVE Module outlines, which are still being added to, cover similar areas to those covered by BTEC units (those currently available include: Engineering Drawing; Electronics; Electrical and Electronic Systems; Microcomputers and their Applications; Motor Vehicle Engineering; Engineering processes; Physical Science; Fabrication and Welding and Consultation Service Installation). These are tending to be seen as leading into BTEC Level 1 units.

BTEC or City and Guilds qualifications gained within CPVE could overlap with those required to be taken within EITB's Technician or craft training programmes, dependent on the level of attainment and the courses followed may lead to specific exemptions. In these cases, exemption is given at the discretion of the college or providing organisation; `partial' exemptions can also be granted, in which case `topping up' courses are devised to meet the student's needs.

Different Models of Practice

The types of provision offered within CPVE are in practice so variable that the most effective way to describe the range is probably through specific examples. Examples are given below of schemes representing the two main types of provision - one exclusively college-based and one based on a school/college consortium.

Scheme A

(College-based; foundation course equivalent; BTEC units). In the first year of Scheme A, all students applying to do foundation courses were directed onto CPVE courses, which tended to be focussed on specific vocational areas, with minimal provision for `taster' options. A typical engineering programme for example, consisted of: ten vocational modules over all three levels, eight of which were vocationally focussed:

Introductory Level:	one non-engineering `taster' module
Exploratory Level:	one non-engineering `taster' module BTEC Level 1 IT and Microelectronic Craft-based activities systems
Preparatory Level: (BTEC Level 1)	Mathematics Physical Science Engineering Technology Engineering Drawing Information Technology Studies Motor Vehicle Engineering Studies

All `core' studies were integrated into the vocational work at exploratory and preparatory level.

Trainees could combine CPVE with `O' levels, and emerged with up to three types of certificate - a Certificate of Pre-Vocational Education, BTEC Unit certificates and GCEs. None of the specially-designed CPVE modules were used within the college.

Of ten students who followed this course, all but one entered engineering: four of these are still at the college doing day release BTEC Level II within technician training; one is doing day-release City and Guilds 205 within craft training; and one is doing full-time Level II BTEC. (The area is one in which engineering is an expanding industry, and students would expect to go into jobs with little delay.

In the second year of this scheme, the style of provision has been changed slightly, though the strongly vocational focus remains. One of the main changes is the inclusion of a separate core, which now consists of:

separately timetabled numeracy and communication (could be English, Maths `O' Levels; RSA or college-devised).

a `special core' consisting of one module per week of three out of four of:

Science and technology
Information Technology

Industrial Social and Environmental Studies
Creative Studies
(The student omits the one which is closest to his or her vocational specialism).

The `special core' options are all college devised.

Students with a primary vocational interest in a different area might take a single BTEC `taster' module in engineering, but this would be unusual and would have little currency even if the trainee later decided to specialise in engineering.

Scheme B

(consortium-based; CPVE and BTEC modules at preparatory level).

All students within this consortium of seven schools and one college are based in the school, where the CPVE course starts with an intensive two-week induction.

Thereafter, all `core' work is done separately within the school, along with any agreed school-based additional studies, and vocational work takes up one or one-and-a-half days a week in the college.

Four distinct types of core studies are followed within the school, all of which are designed to include numeracy and comunications skills:

1. Vocationally-related core skills. Jointly designed by school and college staff to complement college activities.

2. Social, cultural, and general educational core.

3. Specific Skills.

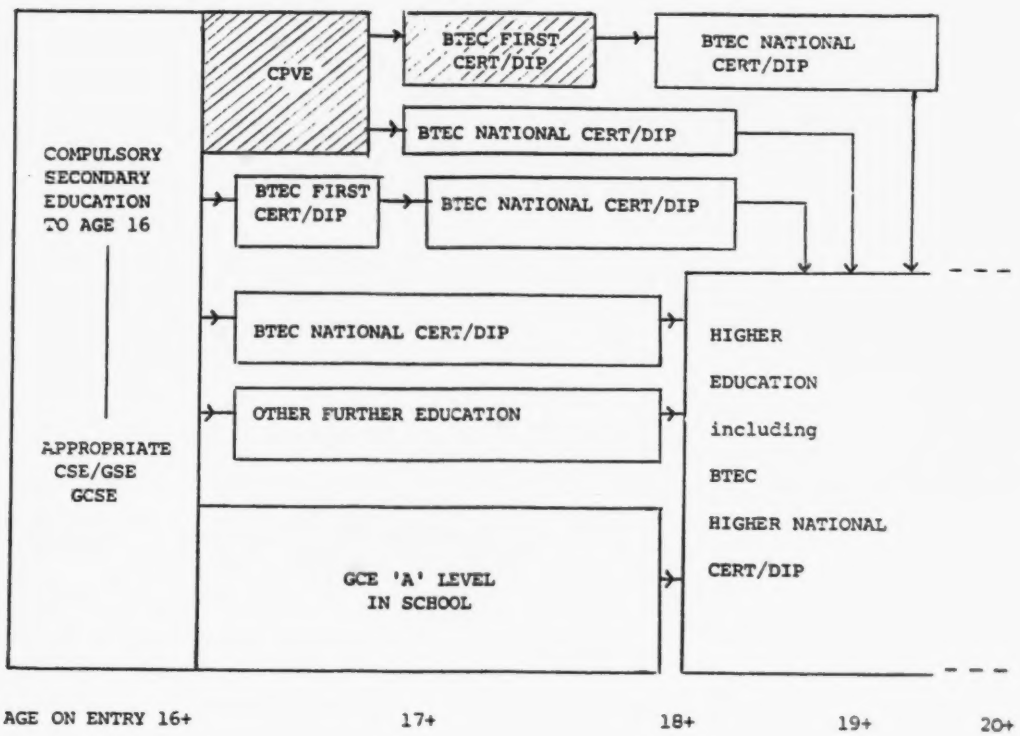
4. Social and personal skills.

Within the college, students follow `tailor-made' programmes after a general induction period. Exploratory and preparatory work need not be taken at all, if the student wishes to extend the `taster' periods of introductory work over the whole year. Assuming that modules at all three levels are taken, however, most of the year from December onwards would be taken up with preparatory work with up to nine weeks of the first term taken up with exploratory work, and a minimum of four weeks spent on introductory work.

All preparatory work is either based on CPVE modules or BTEC units, with the college separating the group into, roughly, a craft group (which follows the `CPVE' route), and a technician group (which takes BTEC units) after December.

The `craft' group would typically take a set of modules which would prepare them for the BTEC First Certificate or Diploma, as shown in Figure 5, while the `technician' group would take BTEC units leading to the BTEC National Certificate or Diploma, as shown in Figure 6.

Figure 5

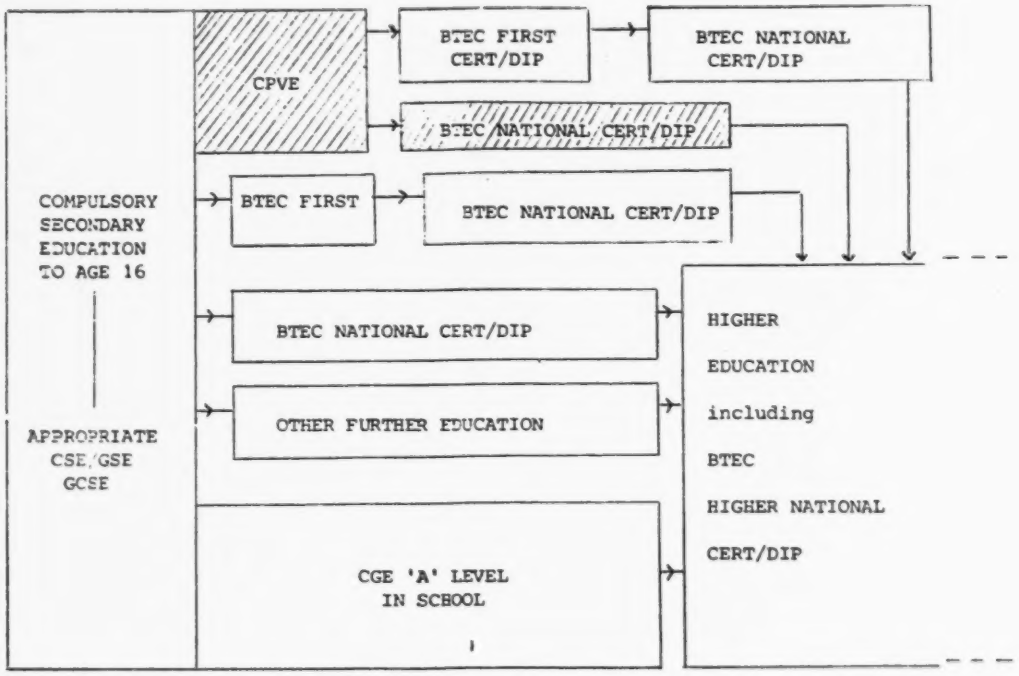


Preparatory Modules
Physical Science
Engienering Drawing
Engineering Processes

Additional Studies
Motor Vehicle Engineering)
Electronics)
Fabrication and Welding) Preferably 1
Micro Computers and Applications)

Core
Mathematics) Minimum CSE Grade 3
English/Communications)

Figure 6



Preparatory Modules (BTEC level 1 units)

Electrical/Electronic Engineering	Automobile Engineering	Mechanical & Production Engineering
Physical Science	Physical Science	Physical Science
Engineering Drawing	Engineering Drawing	Engineering Drawing
W/Shop Processes & Practices	W/Shop Processes & Practice	W/Shop Processes & Practice
Microelectronic Systems	Vehicle Technology	
Electronic Systems		

Core

Mathematics)
English/Communications) Equivalent to CSE 1/GCE C

Other Models and Variations

Within the two broad models of provision which Schemes A and B illustrate, there are of course many additional variations in course design including the use of college-devised and City and Guilds modules alongside or instead of BTEC or CPVE units.

However, it should be noted that there are also other, less common, models of provision which are not described here:

(i) Exclusively school-based provision is less common in engineering than in other vocational areas because of the level of resourcing required, but some sixth forms do run courses.

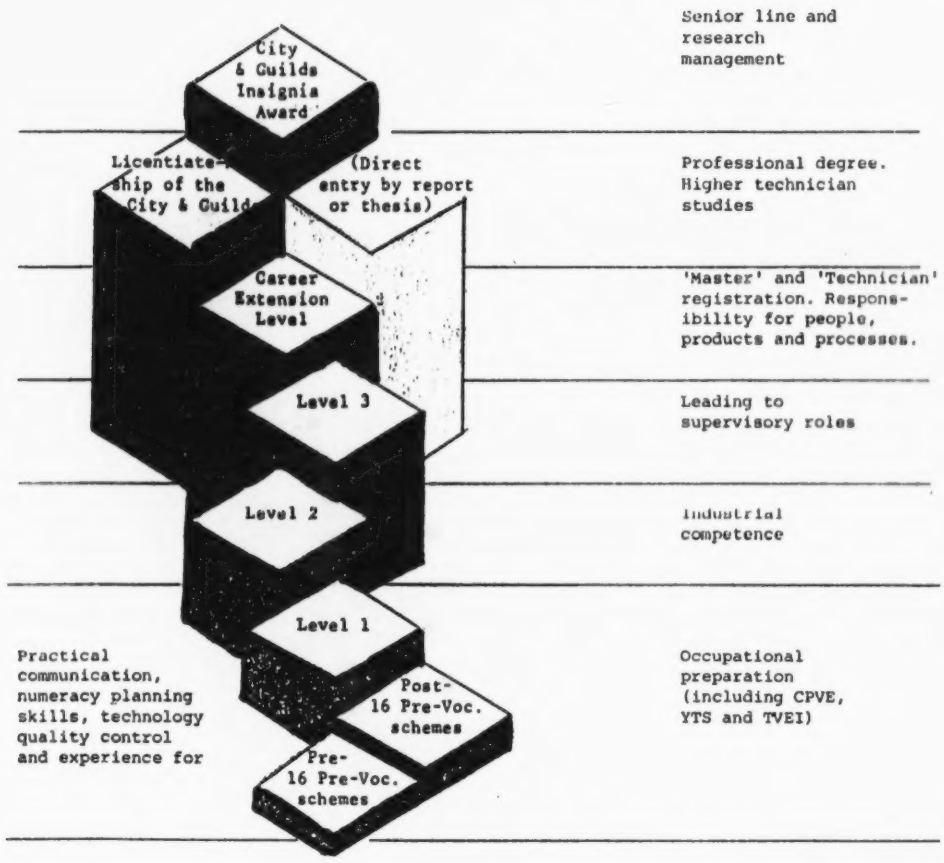
(ii) Increasingly, joint CPVE/TVEI courses are emerging at 16+, which may or may not be exclusively school-based.

(iii) Some college-based courses are run purely on the basis of student demand, and are more flexible than either of the models above would allow, claiming to structure their courses entirely around individuals' attainments and aspirations. In these cases, no written course outline can be formalised. These courses may be run alongside full-time BTEC and City and Guilds courses (in one such case at least was felt to inhibit demand for a fully student-centred CPVE engineering course).

CITY AND GUILDS

The City and Guilds of London Institute provides an integrated system of syllabuses, examinations and certification, which is produced in line with recommendations from its Policy Committee for Education and Training composed of representatives of industry, education and training. It provides a unified system for national training standards and national certification in general and specific vocational preparation. The courses are organised in a progressive pattern of levels as shown in Figure 7.

Figure 7


City & Guilds Insignia Award
Licentiate-ship of the City & Guild
(Direct entry by report or thesis)
Career Extension Level
Level 3
Level 2
Level 1
Post-16 Pre-Voc. schemes
Pre-16 Pre-Voc. schemes
Senior line and research management
Professional degree. Higher technician studies
'Master' and 'Technician' registration. Responsibility for people, products and processes.
Leading to supervisory roles
Industrial competence
Occupational preparation (including CPVE, YTS and TVEI)
Practical communication, numeracy planning skills, technology quality control and experience for

There are no specific entry requirements, and the responsibility for the recruitment of students onto courses rests with the institutions - mainly Further Education colleges but also schools - which place students according to their needs, abilities and interests. The institution also has the flexibility to give students credit for previously gained experience, and, if they have demonstrated that they have gained appropriate levels of attainment, exemptions for parts of the course can be given.

City and Guilds courses are usually organised in day or block release for people already in employment on a training programme or as part of YTS.

The Basic Engineering Craft Studies (C&G 200) was introduced in 1969 and assumed that participants were receiving complementary training, principally EITB training. Since then there has been a dramatic decline in the number of jobs in traditional manufacturing due to economic decline as well as the development of new technology. This has meant that courses must provide for people who:

- may expect to change their jobs more frequently
- may be required to exercise a broader range of skills
- may be required to adjust rapidly to new working techniques
- may have little idea of what work may subsequently be available (as with YTS trainees)

The response towards the end of the 1970's was for City and Guilds to assess the influence of the changing environment on Education and Training - thus the Hargreaves Committee (now the Policy Steering Group for Engineering) was established.

Its report published in 1982 recommended that:

1. There should be new flexible and integrated certification arrangements which allow students or trainees to move in and out of the system and to transfer between occupational schemes whilst being given full credit for their previous attainments.

2. Certification or credit should be competence based.

3. New schemes should address the whole range of engineering craft skill and not only those in traditional engineering industry.

4. New schemes should develop transferable engineering skills.

The recommendation led to the development of the new scheme Basic Engineering Competencies (C&G 201) which at its outset recognises that:

a. not all students are employed
b. not all students receive formal training
c. what may be termed `engineering skills' are used in many

industries outside the engineering manufacturing industry

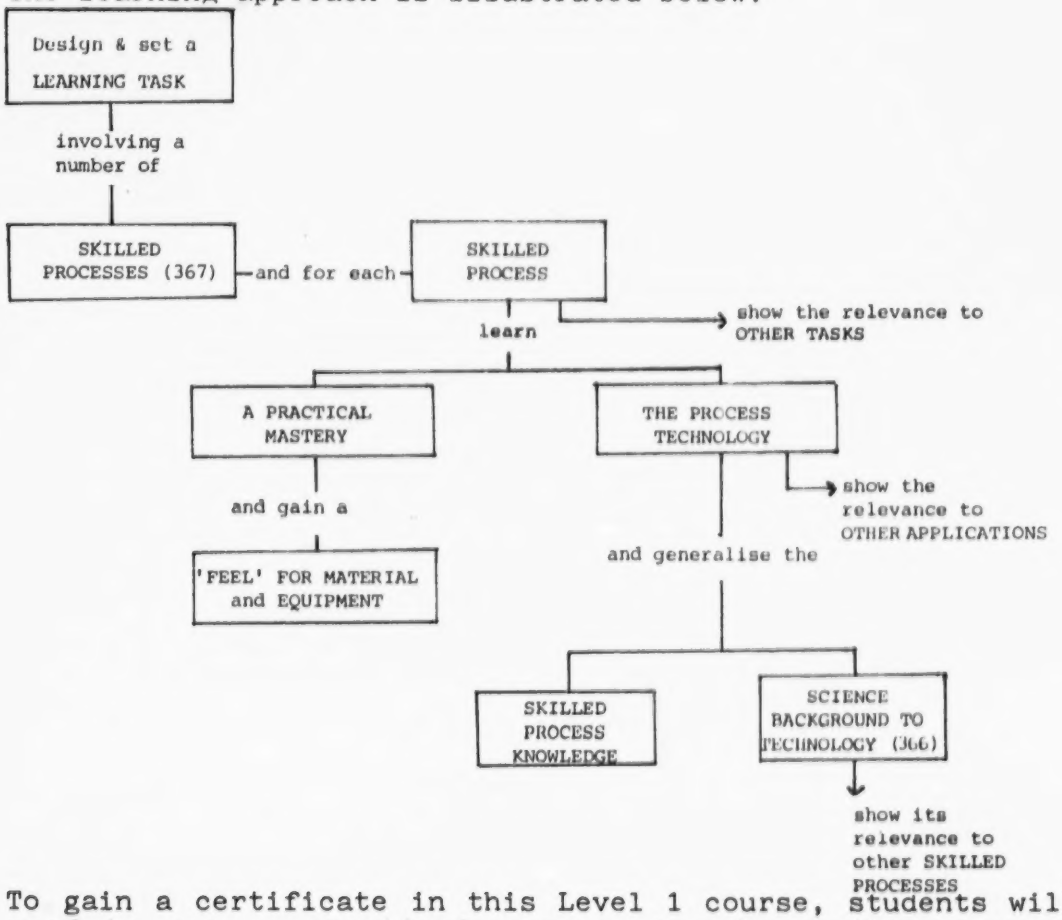
d. the same skills are required in a variety of engineering roles, and not only by craftsmen.

C&G 201 is aimed at a range of occupations and it is hoped will help to form a bridge between academic (CSE, GCSE), pre-vocational (CPVE) and vocational (YTS) courses.

The scheme is designed to be competence based where competence is displayed through skill, knowledge, attitude and experience in performing a work-based activity. The course is taught through task-based activities involving four key areas:

1. Communication
2. Planning
3. Doing
4. Checking.

The learning approach is illustrated below:



To gain a certificate in this Level 1 course, students will need to pass a practical component and a written paper- `Basic Engineering Technology'. The practical component involves 2 projects which assess the students ability to determine, plan and undertake a task and finally check the outcome against the specification.

Credit can be given for students' previous experience and thus the progress through the course will be accelerated towards the more specialised endorsements in Mechanical Production Technology, Fabrication Technology, Maintenance Technology,
Electro-Technology or Science Background to Technology.
Further endorsements are being produced. The C&C 201 endorsements lead to further specialisation in the existing Level II courses as shown in Figure 8.

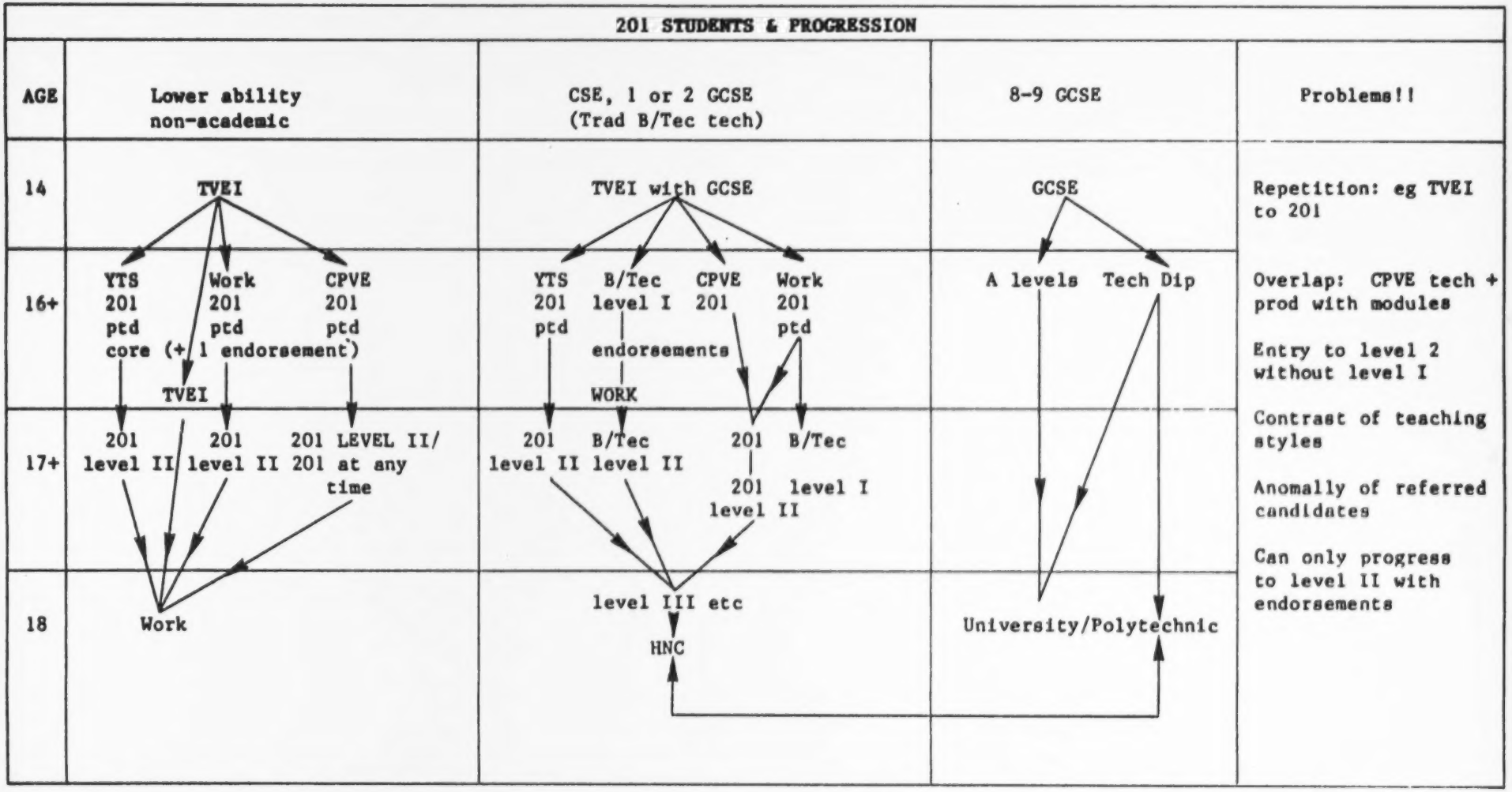
This new scheme has been accepted by EITB as being complementary to its programme of industrial training, and will receive certification between EITB and C&G. The pilot schemes in C&G
201 were conducted in 1985-86, and the course will run alongside existing schemes from September 1986. From September 1987 the 201 will replace Basic Engineering Craft Studies (200), Basic Engineering Process Studies (200) and Industrial Operatives (150).

Routes of entry into C&G 201 and progression from this course are shown in Figure 9.

FULL TIME
C.P.V.E.
Y.T.S.
DAY RELEASE
(1) Basic Engineering Tech.
201 - 1 - 01
(2) Qualifying Tasks
201 - ' - 02
LEVEL I COMPETENCES
LEVEL I ENDORSEMENTS
Fabrication/ Welding
201-1-07
Maintenance Technology
201-1-09
Electrical Technology
201-1-11
Mechanical Production Technology
201-1-14
Science Background to Technology
201-1-04
LEVEL II UNITS
Fabrication Welding
229
Maintenance
214
Mechanical/ Production
228
Computer Aided Engineering
230
B/TEC Units

Figure 8

FIGURE 9 PROGRESSION FROM CITY AND GUILDS 201



BUSINESS AND TECHNICIAN EDUCATION COUNCIL (BTEC)

BTEC is one of the main national bodies offering accredited vocational courses, and BTEC courses form a recognised part of many work-based training programmes, such as YTS or employer-sponsored foundation training, and of pre-vocational courses such as CPVE and increasingly TVEI.

BTEC programmes - whether full- or part-time - are normally followed in Colleges of Further Education or Technology, though with the introduction of TVEI and CPVE, they are now also being offered in schools.

All programmes are unit-based, a unit being a discrete module of study, usually including some work experience and comprising 60-90 hours of work. Some units are nationally accepted as `standard' BTEC units, while others are locally devised and assessed with BTEC approval. Both types of units are normally - but not necessarily - grouped together into programmes which are designed to reflect the particular needs of an industry or industrial sector. First-level programmes usually include certain nationally recognised units which give students the basic knowledge needed to perform any job within a given industry at technician or equivalent level; subsequent programmes give more specialised knowledge which prepares them for a specific job function. At the more advanced levels, all programmes lead either to a BTEC Certificate or Diploma : within a Certificate programme substantially fewer units are taken than in a Diploma programme as Certificates were originally designed to be exclusively `part-time' qualifications. There has been a recent tendency, however, for full-time `crammer' Certificates to be offered to students who wished to proceed through Diploma courses more quickly. This has caused concern and from 1987 it is intended that Certificates will once more be available only within part-time courses, so that all full-time BTEC courses will lead to a Diploma.

From 1987, courses will be available at three levels - First Award, National and Higher National - representing progressively more advanced levels of study, with entry to each dependant on attainment within the previous one or on other formal qualifications with established equivalency.(11) In practice, there should be a fairly formal system of exemptions into each level, with `O' level, CSE and City and Guilds qualifications giving exemptions or partial exemptions for particular units or for whole programmes. Similar equivalencies are being sought for work undertaken within CPVE and TVEI.

See Figure 10 for progression routes within BTEC as envisaged after the introduction of the new course structure in 1987. Figure 11 outlines the basic framework for BTEC qualifications.

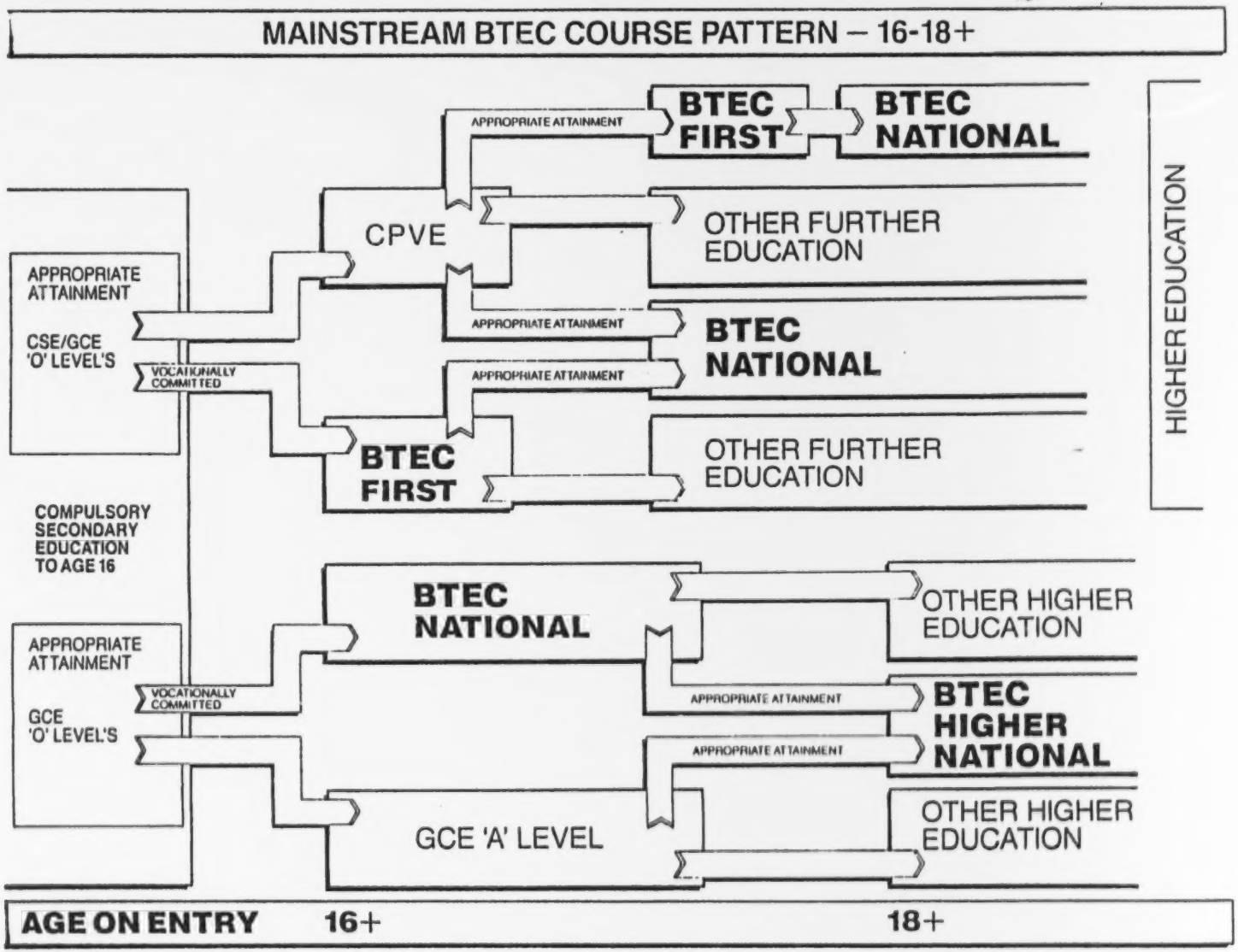


Figure 10

Source: BTEC: Circular 15

FIGURE 11: **FRAMEWORK OF BTEC QUALIFICATIONS**

NORMAL ENTRY/DESIGN BASE	COURSE LEADING TO	YEARS (MINIMUM COURSE DURATION FOR MAINSTREAM ROUTE) PART TIME	YEARS FULL TIME	MINIMUM (LEARNING SUPPORTED TIME) PART TIME	MINIMUM FULL TIME	MIN TOTAL UNIT VALUE	MIN % OF (LEARNING SUPPORTED TIME DEVOTED TO CORE)	PROGRESSION TO OTHER STUDIES
[illegible]								
APPROPRIATE ATTAINMENTS E.G. IN TERMS OF CSE/GCE 'O' LEVEL OR CPVE	CERTIFICATE FIRST	1		300		5.0	50%	BTEC NATIONAL
	DIPLOMA	2	1	480	800 to 900	8.0	33%	
APPROPRIATE ATTAINMENTS E.G. IN TERMS OF GCE 'O' LEVEL OR BTEC FIRST OR EXCEPTIONAL CPVE	CERTIFICATE NATIONAL	2		600		10.0	50%	BTEC HIGHER NATIONAL OR DEGREE OR CONTINUING EDUCATION AND/OR PROFESSIONAL STUDIES
	DIPLOMA	3	2	960	1600 to 1800	16.0	33%	
APPROPRIATE ATTAINMENTS E.G. IN TERMS OF BTEC NATIONAL OR GCE 'A' LEVEL OR EQUIVALENT	CERTIFICATE HIGHER NATIONAL	2		600		10.0	50%	OTHER APPROPRIATE HIGHER EDUCATION OR CONTINUING EDUCATION AND/OR PROFESSIONAL STUDIES
	DIPLOMA	3	2	960	1600 to 1800	16.0	33%	
[illegible]	CERTIFICATE CONTINUING EDUCATION			300		5.0		
[illegible]	DIPLOMA			300		5.0		

77 Source: BTEC: Circular 15

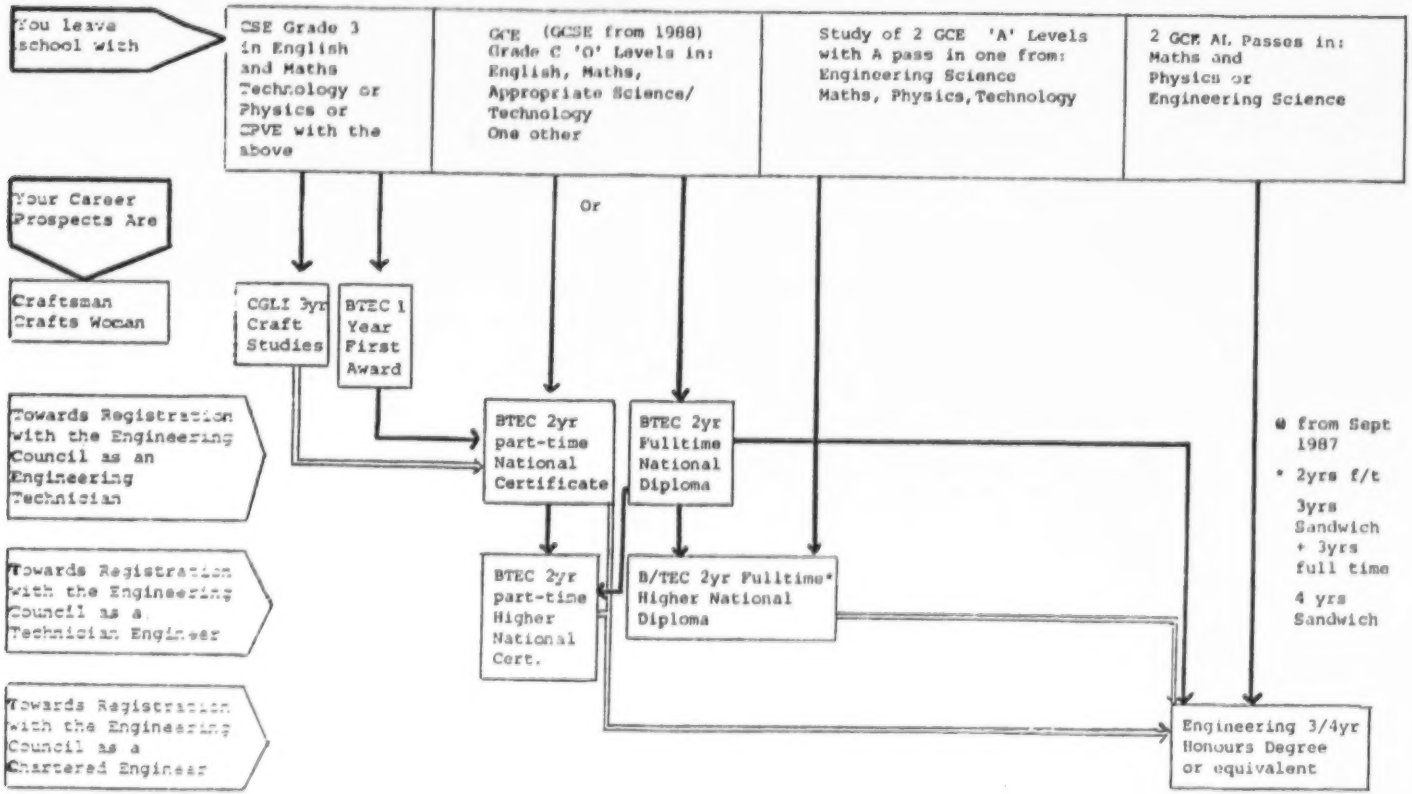
78

BTEC Courses in Engineering

BTEC courses are an essential component of all technician level training in engineering, and may also form part of craft training schemes.

With the introduction of the new BTEC regulations in 1987, (see Figure 12), it will be necessary to have a minimum of BTEC National Certificate to qualify as an engineering technician, (for which the basic entry requirement is 4 'O' levels or equivalent), and a minimum BTEC Higher National Certificate to qualify as a technician engineer (for which the basic entry requirement is BTEC National or A levels).

ENGINEERING: THE WAY AHEAD FOR SCHOOL LEAVERS (BTEC)


You leave school with
CSE Grade 3 in English and Maths Technology or Physics or CPVE with the above
GCE (GCSE from 1988) Grade C 'O' Levels in: English, Maths, Appropriate Science/ Technology One other
Study of 2 GCE 'A' Levels with A pass in one from: Engineering Science Maths, Physics, Technology
2 GCE AL Passes in: Maths and Physics or Engineering Science
Or
Your Career Prospects Are
Craftsman Crafts Woman
CGLI 3yr Craft Studies
BTEC 1 Year First Award
Towards Registration with the Engineering Council as an Engineering Technician
BTEC 2yr part-time National Certificate
BTEC 2yr Fulltime National Diploma
@ from Sept 1987
* 2yrs f/t
3yrs Sandwich + 3yrs full time
4 yrs Sandwich
Towards Registration with the Engineering Council as a Technician Engineer
BTEC 2yr part-time Higher National Cert.
B/TEC 2yr Fulltime* Higher National Diploma
Towards Registration with the Engineering Council as a Chartered Engineer
Engineering 3/4yr Honours Degree or equivalent

Note: For all career grades, Industrial experience is an essential component

Key: → Normal progression ⟹ Possible progression.

Figure 12

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For the new First Award, however, the entry requirements are more flexible, and, whether taken full-time or as part of a CPVE course, First Award is seen primarily as a way of progressing into BTEC National courses for those without `O' level equivalents.

The new regulations prevent colleges from offering full-time National Certificates to those without the basic entry requirements, thus effectively making entry to technician training more stringent. Organisations which have formerly recruited technicians at 16 with less than the `standard' 4 `O' levels (ie. English, Maths, Physics or Technology plus one other) will be faced with the choice of recruiting from higher ability students only or paying for an additional year of further education to bring their recruits up to BTEC National entry levels. CPVE courses may circumvent this problem if employers are willing to recruit at 17+.

All BTEC programmes are unit-based, and individual BTEC students will have - to some extent - a `tailor-made' combination of units, based on exemptions for previous attainments. The list of BTEC units in Mechanical and Production Engineering (Figure 13) gives the range of the standard units in this area, including those at levels 1 which are used in the `General Engineering Model Programme'.

FIGURE 13: Standard Units: Mechanical and Production Engineering National Certificates and Diplomas *

Reference	Title	Level	Value	Page
U80/681	Workshop Processes & Materials	1	1.0	23
U80/682	Physical Science	1	1.0	31
U80/683	Mathematics	1	1.0	37
U80/680	Engineering Drawing	1	0.5	48
U80/678	Engineering Drawing Appreciation	1	0.5	50
U80/679	Engineering Drawing	1	1.0	57
U80/734	Engineering Science	11	1.0	63
U80/691	Mathematics (1)	11	0.5	70
U80/712	Mensuration	11	0.5	76
U80/692	Analytical Mathematics	11	0.5	81
U80/736	Manufacturing Technology	11	1.0	87
U80/738	Materials Technology	11	1.0	93
U80/735	Engineering Science	111	1.0	99
U80/710	Engineering Drawing	11	1.0	105
U78/484	Non-Destructive Testing	11	1.0	109
U80/719	Use of Computers	11	0.5	117
U80/720	Computer Assignments	11	0.5	122
U75/058	Mechanical Science	111	1.0	127
U75/062	Electrical Science	111	1.0	133
U79/562	Thermodynamiss	111	1.0	139
U79/609	Fluid Mechanics	111	0.5	145
U80/688	Statistics	111	0.5	149
U80/689	Calculus	111	0.5	155
U80/690	Algebra	111	0.5	161
U80/713	Mathematics	111	1.0	167
U80/737	Manufacturing Technology	111	1.0	168
U78/476	Materials Technology	111	1.0	174
U80/711	Engineering Design	111	1.0	185
U75/051	Control of Manufacture	111	1.0	184
U80/722	Use of Computers	111	0.5	183
U80/721	Programming in Fortran	111	0.5	193
U80/723	Computing Assignments	111	0.5	198
U79/614	Economic and Financial Studies	111	0.5	200
U79/639	Microprocessor Appreciation	111	0.5	206
U78/450	Introduction to Health and Safety at Work	F	1.0	211

* Source: BTEC National Awards. Mechanical and Production Engineering Guidelines and Units

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11. THE DEPARTMENT OF EMPLOYMENT AND DEPARTMENT OF EDUCATION AND SCIENCE (1986) Working Together. Education and Training. Cmnd 9823. HMSO.

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ATTITUDES

During the course of the research, structured and unstructured interviews with individuals in schools, colleges, training centres and industry occasioned many discussions of the broader issues relating to progression, technology education, training in the industry, recruitment, skill needs and shortages, industry-school liaison, YTS, TVEI, CPVE and a host of related topics.

Putting together this wide range of views, an interesting picture emerges of how the various parties to the education and training process see each other, and, in the end most importantly, the students and trainees who provide them with their common interest.

This section summarises the views expressed in these discussions and also draws on the content of especially commissioned papers written by individuals active in these areas. In order to supplement the picture which emerged from the interviews, a number of key educators, trainers and engineers were invited to comment on the topics with which the research is centrally concerned. (Apart from the provision that the views expressed should be personal rather than organisational only a very basic framework for comment was suggested by the researchers, which is included as Appendix 4)

EMPLOYER ATTITUDES

During the research over thirty engineering employers or their representatives were interviewed and many impressions were gained of the attitudes which employers held on the broad issues of schools and schooling; on the new technology courses such as TVEI and CPVE; and on how all of these affected their recruitment and training.

Recruitment

Most importantly, the employers presented fairly clear ideas about the sort of youngster they want to recruit. At all levels, the first requirement is for motivation, enthusiasm and a positive attitude, followed by basic mathematical and communication skills. Employers vary in the value which they place on formal academic qualifications, even where the jobs they are recruiting for seem similar in content, as illustrated in their attitudes to the new BTEC regulations restricting technician training to candidates with 4 'O' levels or equivalent. Some employers saw this as unreasonably restrictive while others viewed it as a realistic filter, and to some extent the difference of opinion seemed to be based simply on personal preference and past experience.

Overall, however, most employers took into account attainment in CSEs and `O' levels, and have `rules of thumb' about necessary levels of attainment. Where recruitment takes place before exam results are available, many do their own formal testing, especially in mathematics, in an attempt to predict likely attainment. Most employers, however, did not expect youngsters to have specific engineering skills, seeing these rather as a bonus, and few do any practical skills testing as part of their selection process.

General concerns within the industry centre around the difficulties of recruiting `good' trainees into mechanical engineering (particularly at craft level), academically able trainees into technician jobs and girls into the industry as a whole. Despite this, however, many companies still report very high numbers of applicants for training places with employed status (as opposed to YTS places), which increases the difficulty of selection.

These concerns were brought out by many of the employers approached:

> `Despite the growth in technology there are vast shortages within the areas of Engineering Craftsmen (Machine Operators, Electronic Assembly Workers etc.) and also Technicians.
> These shortages are becoming increasingly difficult to resource because of the decline in the popularity of Engineering as a career, with many of those wishing to follow engineering moving towards Computing and Software Engineering'. (Training Officer in a large national company).

> `Electronics personnel are scarce at all levels as are any personnel with computing skills. This shortage is particularly acute at Technician level (ie. those undertaking TEC National and Higher National Certificates) and results in many graduates undertaking technician level jobs. We also experience difficulty in attracting young people to enter Craft Apprenticeship schemes because even skilled craftspeople are held in low esteem. Many of the jobs we have to offer involve both practical and mental skills and command considerably higher pay than the routine office jobs that follow our shorter clerical training schemes (same entry requirements). This is true of sites only in the South of England and as one might expect all our Northern sites have many times the number of applicants to job opportunities .... As an additional comment we suffer a shortage of female engineering applicants...'
> (Development and Training Manager in a large nationalised company).

Schools and Schooling

Very closely linked to employers' ideas of what characteristics they are looking for in their recruits are their views on what schools should be aiming to achieve, what they currently are achieving and how they are going about it. (Many employers of course also speak both as parents and ex-pupils, and often reflect these perspectives in their overall views).

On the basis of our interviews and invited comments, it would seem to be an exaggeration to suggest that employers are universally in favour of a heavily focussed vocational curriculum, whether the focus is on engineering or elsewhere. Any vocationally relevant skills which trainees bring with them to the workshop are valued, and any training exemptions which these might represent are automatically welcomed if they bring genuine savings of time and resources. However, there is an often-expressed concern that they should not be gained at the expense of `basic' skills and understanding: frequently these `basics' are seen in terms of the `3RS', but often a wider perspective is adopted:

> `Examination results are a useful marker in particular because entry to further and higher education largely rests on them. However the key qualities we are looking for are
>
> - analytical problem-solving skills
> - ability to learn and adapt
> - inquisitiveness
> - reliability
> - ability to fit into a team
> - ability to accept responsibility (for one's work and the progress of one's training)
> - observation, listening and communication skills
>
> These qualities are perhaps drawn out at school not by the subjects themselves but by their interaction and by the teaching approach'. (Training Manager).

> `Under the current system of education, industry looks upon the schools to provide young people with a basic standard of education upon which engineering training can be based. Industry also looks to schools and the careers services to provide young people with an understanding of the background to their chosen career.
>
> The third area where industry looks to the schools is in the area of personal development and personal effectiveness. This is to ensure that young people are able to work in the new adult dominated environment.
>
> Under an advanced education system industry should be looking towards the schools to provide young people who have a basic engineering background which can act as a

> foundation upon which specialist engineering skills can be developed. This is along with an understanding of industrial organisation and personal effectiveness'. (Training Officer).

This last training officer continued `The engineering industry should see any vocationally based course as being a positive step forward within education. However the question does still arise as to how effective they are in their present format'.

There is some feeling that schools ought perhaps to steer clear of specific training-style activities, and many reasons are cited for this view: school resources are not seen as adequate; or are seen as inappropriate for industrial purposes; teachers are seen as lacking industrial experience; and the teacher shortage in technology is acknowledged as problematic. Perhaps more fundamentally, there is a strong feeling that training should be the concern of industry, if only because schools cannot realistically keep up with the rate of change. One Manager commented:

> `With the ever increasing rate of change of technologies and hence skills required it would be a very responsive and fast-moving education system that could turn out the required skilled workforce in the correct numbers to meet changing demands'.

Other comments ranged from:

> `Staffing levels and the areas of teacher competence are currently insufficient to offer effective teaching'.

to:

> `vast amounts of money are being spent within the schools in an attempt to offer up-to-date technology for pupils. This is especially true in the areas of CNC machines, CAD/CAM and Information Technology ... Much of what they are learning is outside of the scope of industrial requirements. It is true that modern technology students need to be aware of the capability of the modern equipment but they do not need to be masters of expensive training machines, bearing in mind that most if not all employers train to meet the requirements of their own organisation and equipment'.

Employers' expressions of general dissatisfaction with the educational services are commonly reported and well documented. A recent survey conducted for Channel 4 television (1) confirmed that similar attitudes to those quoted above were prevalent in a sample of 1000 chief executives in British industry: 89% felt that schools were failing to meet industry's needs; 79% that the curriculum should be made more relevant to work; and 74% that industry was the best judge of its training needs.

Implied in these statistics seems to be an understood distinction between what schools can properly do within the framework of vocational education and the skills training which industry frequently sees as its own preserve. Schools, it is felt, cannot or should not encroach too deeply on the latter.

There was almost universal agreement among the employers approached in this research that more and better school-industry liaison was the main way both to increase the relevance of the curriculum and to establish where the demarcation lay between school- and industry-based learning.

Training staff in many companies were actively involved and made specific suggestions for improving liaison, including:

- `- secondment of teachers to industry as a normal part of their career (say 1 term every 5 years).
- secondment of suitable engineers and business professional into schools. (As advisers to teachers and to help teach). This would be particularly appropriate in business studies and CDT.
- on a smaller scale engineers and business professional seconded to teach particular lessons about which they have relevant knowledge.
- industrial members on education management committees -Board of Governors.
- industrial involvement and advice on subject curricula.
- teachers attending industrial management courses and vice versa.
- school students attending industrial management courses.
- work shadowing and work experience'.

Most employers, however, felt that links were at present inadequate, and a number of practical difficulties were quoted in this respect, including the difficulty of finding work placements, the attitudes of both teachers and industrial personnel and the expense and inconvenience of freeing staff for industrial tutoring. Underlying all of these specific reasons, however, there is often a general feeling that in present circumstances effective liaison is simply not realistic:

> `I believe Industry and Education have yet, in many instances, to learn a common language. Some Education Authorities and teachers with which I have had dealings still see the links as a one way process. Money and visits will be accepted, but not advice'. (Training Manager).

> 'At present much of the British Engineering Industry is not geared to offer reliable links with schools and colleges. School links are often seen as a burden on a company that may be facing high financial controls or staff shortages. Other organisations use these projects more as P.R. exercises rather than as a development programme for the pupils. In general most of industry does not take the task seriously, with much of the long term work being carried out by a small number of larger national companies, with on occasion a small organisation passing on small projects which they are unable to effectively carry out themselves due to time scale ... Industry as a whole is far too complacent about the current situation, and needs to take a far more active role in supporting industry and education links'. (Training Officer).

Despite this, recent educational innovations which involve industry more closely in school work are frequently seen as genuine steps in the direction of better communication and understanding and are welcomed as such. The following section explores engineering employers' views on two of these specific developments - TVEI and CPVE.

School Courses

Very wide variations were found between different employers' attitudes to school work and achievement in technology and craft areas as a whole. Some employers see school studies as having little relevance to training, and discount any practical work undertaken at school even where it overlaps with skills acquired in the workplace. Often this is expressed as a response to the diversity of school leavers' experiences:

> 'For many years the British Engineering Industry has faced the problem of identifying a suitable baseline at which to commence industrial training, the result being that most employers are forced to assume that all of their trainees, be they YTS apprentices or graduates know nothing.... As a result of the number of schools, colleges and regional examining bodies... it is impossible to identify a set of common standards'. (Training Officer).

Sometimes, however, it is a clear and deliberate policy: many YTS schemes for instance, are non-selective, and where trainees school attainments are few, the trainee is seen as benefiting from the chance to 'start again' in a new environment. In selective schemes, on the other hand, it is felt that many able youngsters would slip through the net if recruitment was restricted to those who had done 'relevant' courses at school.

Where practical skills have been acquired, industrial trainers often express reservations about their transferability: many employers will not consider a skill to

be genuinely acquired unless the trainee has first undergone the relevant in-company safety training; others feel that a skill which has been acquired without reference to industrial standards of accuracy is in fact worse than no skill at all. In these cases, trainers consciously go 'back to zero'.

Usually, however, the value of some craft training is acknowledged as a useful foundation. The general view of most companies is probably summarised in the following quotation:

> 'While many of these courses have their shortcomings in terms of content and quality of teaching, they are generally helpful in that they provide students with a foundation of practical skills and technical knowledge upon which to build.
>
> Safety consciousness and experience of the real working environment is the most notable failing ... (but) ... the ability to read and understand technical drawings has been a positive factor in training'.

A minority of employers, however, are more closely involved with local school courses, have a detailed knowledge of syllabus content and maintain close contacts with teachers. These employers often design individualised training programmes around trainees' previous experience as a result. Others, however, with equally close links, see this as a future development which may follow the introduction of more vocationally relevant courses such as TVEI, consciously reflecting what is seen as only peripheral overlap in current programme designs.

TVEI

Most employers have only limited experience of TVEI, but express cautious enthusiasm, though they are inevitably witholding judgements in many cases until they have taken on trainees with a TVEI background. Most will at present offer exemptions only on the same basis as they would for CSE or GCE craft or technology attainments, with some concern expressed about the quality of school-based City and Guilds and BTEC courses, which are frequently a central component of those TVEI courses which focus on engineering:

> 'I do know that many of my Training Manager colleagues do not believe that C&G or TEC or BTEC courses should be taken at school as they have said that schools do not offer the same learning environment as industry and college'.
>
> (Employers are even reported as asking TVEI students for 'translations' of City and Guilds certificates into CSE grades before offering them a training place!).

As familiarity with the scheme increases, however, these reservations seem to diminish.

Perhaps a more serious concern is one which also troubles many educationalists - that TVEI is an option for the less academically able. This is expressed very clearly by a Training Manager who has a close involvement in the development of TVEI programmes:

> `Most industrialists are impressed with TVEI and the new interactive approach implicit in TVEI schools, but it would be fair to say that as TVEI is in relative infancy and apparently has some strong opponents from within Education, there is some degree of caution.
>
> There is a danger that it could become the route for low achievers rather than all levels of ability and I have sat at meetings where Headteaches have said that "A" level students could never consider the 16-18 TVEI route and that the brightest "O" level students would be discouraged'.

Difficulties in establishing `standards' are seen as even greater for TVEI courses than for GCE and CSE courses, due to variations from school to school and district to district, and this is also frequently cited as a reason for witholding judgement until the scheme has had a chance to develop.

Overall, however, TVEI seemed to have been well received by the engineering trainers approached in this research. Despite unfamiliarity and newness, nearly half of the twenty-three employers in our study who were recruiting in TVEI areas were either actively involved in TVEI (6 employers), or were at least familiar with it (5 employers). No less than eight saw the potential for agreed exemptions from TVEI into their training programmes, whether on an individual or group basis.

While the schemes which contributed to the research were not randomly selected, they were nonetheless seen as `representative' in this as in other respects, and there is no reason to think that these are not in a general sense reflective of attitudes among employers nationally (though again it should perhaps be noted that our research tended to focus on organisations with established training programmes rather than individual trainees). This level of involvement at a relatively early stage in TVEI's evolution can only be seen as encouraging.

CPVE

Few employers in the study as yet held firm views on CPVE or had experience of the course which possibly reflects both its recent introduction and the predominance of non-technological courses within the framework. Many employers were in fact quite unfamiliar with it when asked for their views; when the CPVE framework was described, however, the most common response was concern that the age requirements would inhibit recruitment into the industry.

Where interest was expressed it was in the context of developing joint CPVE and YTS provision within a group training centre.

In this particular area, it can only be concluded that as yet CPVE has to make its impact on the types of engineering training organisations covered by this research, though this is undoubtedly an area in which further work needs to be done when the courses are more established.

COLLEGE ATTITUDES

In view of the major changes to college organisation and teaching styles which have been involved in the introduction of YTS, CPVE and in some instances TVEI, college lecturers' and coordinators' views were sought on the impact of each of these schemes and on their changing relationships with schools, managing agents and employers.

In total interviews were conducted with staff in over 25 colleges of further education and technology and technical colleges, sometimes following the structured interview outlines in Appendix 2, and sometimes on a more informal basis. Impressions gained in this way were further substantiated by written contributions.

The Youth Training Scheme

It is hard to exaggerate the impact made on college staff by the introduction and extension of YTS. New demands have been made on the curriculum, and contact made with a wider range of employers and students, often through the mediation of an external Managing Agent who has responsibility for monitoring college provision.

The integration of on- and off-the-job provision has often proved to be problematic, and the inclusion of YTS `core' elements in existing college courses potentially involves some major readjustments. Several studies have pointed to difficulties in these areas. An HMI survey in 1985 claimed that

> `there is little evidence of integration of core skills, vocational studies or work experinece across the various parts of the scheme' (2)

and Roy Boffy, in an article in the NATFHE Journal in late 1984, commented that:

> `there is often little awareness by college staff of what trainees are actually doing at work, and often little integration within college courses themselves. This arises from a lack of coordination and from a conceptual confusion about the content and intent of YTS courses'. (3)

Many schemes have looked outside the Further Education sector for their off-the-job provision. As one college lecturer put it:

> 'increasingly, schemes are providing their own off-the-job training or arranging it with training enterprises outside the FE system ... FE colleges are being rejected for their alleged inability to deliver what is needed in YTS, or in some cases to offer it at a reasonable price'.

However, despite these trends and initial difficulties, college staff are increasingly accommodating the particular needs of YTS trainees into their programmes and in many colleges a large proportion of the training provision now offered is within the YTS framework.

When asked to assess the impact this change has made on the college and on college staff, the most common observation is that they have had to adapt to accommodate a much wider range of students. This in itself can cause anxieties for a variety of reasons.

The range of trainees will inevitably reflect the different types of YTS schemes. Some trainees will be very similar- in terms of level of school attainments, motivation and job status - to the day-release apprenticeship trainees with whom many lecturers were most familiar before the introduction of YTS. Other trainees, however, may be seen as less committed to their training and less motivated generally especially where they do not have employed status within the scheme. Often this lack of motivation is associated with concerns about unemployment, even in areas where school leaver unemployment in engineering is not at present running at a level which is immediately threatening. (In one course in a skill shortage area where almost all YTS trainees were recruited on to apprenticeships, an engineering lecturer commented that the 'general attitude that you would be better on the dole' overrode in some cases a realistic appraisal of employment chances). Sometimes YTS trainees are seen as less committed to their area of vocational choice: one college lecturer in engineering commented simply that:

> 'some YTS trainees lose their motivation half way through their course because they find they don't like engineering'.

College staff also occasionally express concerns about the suitability of YTS trainees for specific FE courses. It is felt that the levels of basic attainment required in some courses are incompatible with the types of trainee who might formerly have gone straight into a job which had no FE and formal training provision.

Most colleges have responded to the anxieties of their staff with YTS-focussed staff development initiatives. In the words of one college lecturer:

> `... the attitude of teaching staff is particularly important, and in some colleges great efforts (are) required to motivate staff into getting enthusiastic about, or becoming involved in, YTS work. In some colleges promotions to Lii were required to attract teachers into taking on YTS responsibilities (eg. course tutorships). YTS is still seen as low level work.'

Increased attention to initial vocational counselling for trainees is also seen as important, to ensure that individuals do not `lose interest'. The open entry policy of many courses and schemes brings with it changes of approach within vocational guidance, for:

> `Although the college may go through a procedure of interviewing/selection, what is really going on is the selection, based on current qualifications, of the most appropriate course for the student's abilities/aspirations and not a competitive selection of students'. (Deputy Head of Department).

Individual college lecturers in engineering also express specific worries about the content of YTS programmes. A lecturer in an area of high unemployment drew out both practical and policy implications:

> `A fairly in-depth knowledge of a certain skill (electrical - mechanical - pipework etc) is in my view essential before branching out. Why? Well the YTS trainee on a part-time course in a FE College will not accept that he is, say, a trainee welder or plumber all week apart from the day he attends college where he is a joiner, painter, fitter, bricklayer, mechanic or some combination ... a young person who is going into a skill area needs a base, an initial trade or technician training ... My point is this - are we (the MSC and FE) really contributing to the reconstruction of the manufacturing society by the sectionalism and consequent minimising of skills?'.

Another lecturer, in the South East, commented:

> `Bearing in mind the relatively low youth unemployment rate in the South East YTS is an exclusively craft student level phenomenon. The advent of YTS, or NTI in its early days, has resulted in the virtual destruction of first year craft courses, and now second year craft as well, and their replacement by YTS. The major problem is that YTS is a shorter course than the 1st year craft and the curriculum differs slightly, so it is difficult to get the students up to Part I standard, as desired by fostering/potential employers, in the time available'.

The same lecturer went on:

> 'The other bone of contention is that the MSC keep on changing the system/rules so that the courses never have time to stabilise enough for staff to concentrate on developing/refining appropriate teaching styles/techniques and when the rules change insufficient time is allowed for considered curriculum development'.

College staff perhaps inevitably feel more confident about the quality of on-the-job learning where the college itself is the managing agent and is able to monitor the placements. The level of monitoring nonetheless varies, which may mirror skill shortages and surpluses in the area. Where there are shortages, the 'matching' of a trainee to a job placement may be done with great attention to his or her aptitutes or needs, and employment offers will be expected to follow. In contrast, managing agents in areas of high unemployment may be pleased to get enough relevant placements for any given group, with the result that standards of monitoring are often seen as less stringent.

In discussing the impact of YTS with college staff, few minimise the difficulties and challenges which YTS initially brought with it for established lecturing staff. However, with the growth of staff development programmes and of the YTS framework itself, wider benefits to the college are becoming increasingly apparent. As one lecturer concluded:

> 'We enjoy a greater degree of consultation with firms, students and each other than was the case before YTS'.

CPVE

The attitudes of college staff involved in CPVE vary almost as much as the types of course offered. In looking at CPVE as a whole during its first year some general impressions come across, however, regardless of the type of course involved: a sense of hasty course construction is one such impression; uncertainty about the future is another. One lecturer summed up this feeling of 'learning as you go along':

> 'With little in the way of additional time, staff have come a long way in responding to ... CPVE, but it has usually been response 'on the run'. Complete schemes have been mounted in as little as a fortnight, attempts have been made to introduce more participative, experiential and integrated methods and materials...'

With engineering-related courses this feeling is perhaps even more marked than elsewhere, as courses within the Technical and Production vocational categories have not been established as widely as they have within the Business and Administrative Services, Distribution and Services to People categories. There are a number of reasons for this, which

are discussed elsewhere, but the result has tended to be that the courses have been developed in isolation, and that lecturers are less certain of future developments.

CPVE provision within engineering is very diverse, and while no attempt is made in this section to describe different schemes, it has been necessary to make distinctions below between the attitudes of those involved in different types of scheme.

College/School Liaison

Most engineering work within CPVE is undertaken either exclusively in colleges or in a college/school consortium, (largely because of college access to more technical workshops and equipment) but some schools and sixth form colleges run their own courses, increasingly within the TVEI framework. College views of school provision, however, tend to focus on the shortage of industrial-type engineering facilities which lead to specific difficulties when students progress to college courses:

> `Some school CPVE students are coming to the college and having to be `topped up' with extra City and Guilds and BTEC work to progress into, say, BTEC National. So they are joining college CPVE classes, effectively doing CPVE for a second year. Schools could help by providing very detailed profiles along with good examples of students' work'.

Communication with the schools is also a major concern in consortia, and college staff occasionally quote examples of very basic communications breakdowns which can lead to disruption: colleges may not know when school holidays or work experience blocks interrupt the programme; or may not be informed of changes to the schools' programme. (Schools also make very similar complaints about communications with colleges in practice!) Sometimes students are clearly aware of gaps in coverage or duplications before staff in either institution.

Where communications are good at all levels, not just at coordinator level, the scheme seems to benefit.

One CPVE coordinator summarised his view that these problems resulted in the necessity to increase liaison within CPVE which in the end would produce a general improvement in communication:

> `It is through personal contact that understanding occurs. Opportunities for lecturers and teachers to meet are essential. Incentives for meeting? Possibly the necessity for curriculum development in areas of CPVE and TVEI will provide these opportunities'.

College Schemes

College-based schemes are very varied, and few generalisations are possible. However, one common type of provision during the first CPVE year is that in which all pre-CPVE foundation courses were initially adapted to become CPVE courses, but only slightly modified in the process, usually to incorporate additional `core' and `taster' elements. Most of the students had a basic vocational commitment, and some would be fully committed to their career choice. However, a growing realisation amongst staff that the CPVE framework had wider practical implications in most cases resulted in the courses being redesigned at some stage. Frequently it also resulted in the reintroduction of non-CPVE foundation courses, thus inevitably reducing CPVE student numbers, and raising doubts in many lecturers about the future feasibility of running Engineering courses within CPVE. These concerns have been reinforced by announcements relating to the introduction of a further new vocational college-based course in the form of the BTEC First Award in 1987:

> `The new BTEC First Award in Engineering clearly competes with the CPVE provision, and may see CPVE decline in take-up significantly after its introduction in 1987. The end result may be that CPVE becomes a lower-ability course, or for the less committed, leading into First Award. There seems to be a confusion about the respective roles of the two courses'.

Developments

The future of CPVE is a concern, however, in all types of schemes, including those which focus more on the `taster' role of CPVE, where it is assumed that students will be the vocationally uncommitted. Some students here are encouraged to do CPVE by the need to retake failed school exams.

> `At 16, a trainee with a real commitment to engineering would do best to go for a good YTS traineeship or traditional apprenticeship or do a full-time FE course. However, there are youngsters who "need an extra year at achool". And there are genuine reasons for wanting to do up to 3 `O's - so many schools do a combined CPVE/`O' package.

In this consortium scheme referred to in this quote, the CPVE course had been designed around the college's experience of cooperating with 12 local schools to teach City and Guilds 365. The CPVE students, it was felt, compared well, in that they were:

> `older, on average of higher ability (if they are combining `O' level retakes) and willing to stay on at school - therefore generally better motivated and better behaved'.

College lecturers, however, in general seem to have mixed feelings about the need for a `taster' year. Where trainees on YTS courses were clearly not benefiting from vocationally-focussed work because they were not committed to the industry in which they were training, CPVE was seen as a better option.

However, there is concern that, if seen as purely a `taster' year CPVE might become associated with the group

> `who don't know where they're going and nobody knows what to do with'.

At present, CPVE is (perhaps inevitably, given the recency of its introduction) seen as having little vocational currency outside the specific qualifications gained within the City and Guilds and BTEC components of the exploratory and preparatory vocational modules.Where preparatory work is not attempted, assumptions about CPVE students already tend to be negative:

> `CPVE lacks credibility at the moment and there are no plans to develop college-based courses because there are strong YTS courses which they would only duplicate. Student quality is a main concern too, as the lower ability don't go into engineering, and we are not equipped to teach for special educational needs in those areas'.
>
> `A year is rather a long time for a person to decide where they are going'.

With the development of First Award, there is concern that students who would currently do preparatory work within CPVE will have no incentive to take City and Guilds or BTEC modules within the framework, as neither First Award nor CPVE have entry requirements, and First Award offers a more direct progression into vocational BTEC courses. Those who do remain within CPVE might therefore be seen by employers as almost taking `time out', and will at most gain only a basic familiarity with vocational skills which might `help them in an interview'. Uncertainties about progression from CPVE to other types of further education, and about its acceptability within the new NCVQ framework, pending national agreements on these issues, are perhaps contributing to these concerns.

This rather negative view of how CPVE might develop is however balanced by much basic enthusiasm for the framework itself. In one college, which had wholeheartedly redesigned all its existing foundation courses in line with the framework guidelines, the engineering staff, `at first sceptical' about the policy decision to adopt CPVE had developed new courses which convinced them that `the negotiated integrated style <u>is</u> a valid way to teach engineering skills'. The view expressed by the CPVE coordinator in this college, (in an area where youth unemployment was a concern) was that:

> `The conventional engineering courses will need to change to accommodate new learner-centred styles. They remain satisfactory if jobs are available at the end. CPVE, however, fits students for a more uncertain future, in which they may be doing electronic, electrical or vehicle maintenance work, for instance'.

This view that the design of CPVE was more appropriate to employment needs was reflected by a head of department in a skills shortage area:

> `This year, the `taster' elements in CPVE have been cut down ... but the students find even this unattractive ... The trend is unfortunate, as in my view `core' and `taster' work could usefully be introduced into all courses, including `O' and `A' levels'.

The sometimes sharply contrasting views about CPVE expressed by college staff are perhaps indicative of the way in which CPVE can be adapted to different contexts. Its student-centred framework can reflect different local employment possibilities, and accommodate a range of student ability levels.

Its approach was perhaps best summarised by a college coordinator:

> `The essence of CPVE is that each course has relevance to the local situation'.

STUDENTS' ATTITUDES

A range of Engineering trainees was interviewed to discover their experiences of engineering courses and the value of courses in school in preparing them for a career in engineering. They were also questioned about their reasons for chosing a career in engineering, and their experiences on application for engineering training including company recruitment techniques. The questionnaire used for this is found in Appendix 2.

The overriding influence on young people when chosing an engineering career is the direct experience of family and friends. Other sources of information were careers teachers, careers evenings, careers officer, and one girl mentioned a Women into Science and Engineering (WISE) conference which convinced her that she wanted a career in engineering.

Students had experienced a wide variety of courses in school: CSE, GCE in Technology, CDT, Metalwork and Technical Drawing and C&G 686 were commonly mentioned whereas some students had not followed technology courses but instead Physics courses.

At 14 when choosing their courses, pupils tend to feel a pressure to opt for courses which they see as directly relevant to their future career if they are vocationally committed, whereas others who reach their decisions later tend to choose a broader based course.

TVEI, with its emphasis on courses relevant to the pupils' future and to the "world of work" in general, has been chosen by pupils who feel that it will provide them with advantages and progress them faster towards their future career. As stated by one engineering trainee:

> "I thought it was a good opportunity to do something towards my career".

and another said:

> "The course has meant quite a lot to me as it has helped me decide on a particular career.

TVEI courses vary greatly in content but one area which has not hitherto been common in schools is electronics. In one TVEI scheme this has been very popular and has helped students to decide on a career in electronics. Girls who have followed the TVEI electronics course have been particularly enthusiastic:

> "I wanted to do electronics and technical drawing which we had never had the chance to do before as we were at an all girls school"

and

> "I like to know how things work".

These comments reflect that the equal opportunities policy in TVEI has strongly promoted the involvement of girls in technology courses, and the TVEI funding has provided the opportunity to develop technology in girl's schools.

The broader aspects of TVEI courses for example industry links, work experience and problem solving approaches, have helped in a general way to provide an awareness of the "world of work". As one student says:

> "It offered discussions, practical work and projects also it offered skills which are not done in school".

At present there are few students who have progressed into engineering from CPVE courses, which on the whole are not seen as appropriate for the vocationally committed youngster. However, the course has helped some students to clarify their ideas.

A number of TVEI and CPVE schemes have developed close links with colleges of FE, and engineering courses have been provided as part of these. Students have been particularly

attracted by courses within colleges, and been motivated by the equipment available to them. A frequent remark is that college lecturers "Treat you like adults" and pupils have responded to the freer atmosphere. On the other hand there have been comments concerning the lecturers' approach, their tendency to separate theory and practical and their lack of response to a younger audience:

> "All we did in the lessons was copy notes from the overhead projector"

and

> "The teachers at college should take things more slowly and talk to the class more and have more patience".

One student felt that college courses could advance students along a career route.

> "When pupils left school they could be granted exemtions if they follow a technical career. The subjects at school could hold back the pupil..... The assessment programme is
> more representative than the old GCE and CSE exams and therefore pupils could benefit".

When students were recruited on engineering courses, their perceptions were that there was a varied reaction to school courses but that on the whole employers and training managers tend to value traditional courses, qualifications such as GCE and CSE and carry out their own tests. These were commonly aptitude tests with practical tests only rarely being given. On the whole, ex TVEI students found that most employers had only a very limited appreciation of TVEI:

> "When I applied for my apprenticeship I found that many of the local and big well known companies in
> did not know about TVEI, what it meant and what it involved".

Trainees found that no exemptions were given for previous experience gained during school courses.

They found that school courses provided familiarization with equipment, but skills needed to be dealt with more thoroughly than they were in schools. Some C&G courses appear to be more directly relevant to students, and allowed them to move faster through the course although subsequently one student had to "fill in the time" by practising welding.

TEACHERS' ATTITUDES

When conducting this research over thirty teachers and advisers opinions were sought, both through informal discussions and by more structured written responses which covered a range of topics including the role of school courses in preparation for a career in engineering, and in particular the development of GCSE, TVEI and CPVE.

Also the role of the TVEI technology courses were discussed with curriculum leaders of TVEI schemes including those who have only just embarked on their schemes to those who have been involved in the development of courses over 4 years.

As one would expect, most teachers are genuinely concerned about preparing their pupils for future life including employment. A problem has been that some teachers may lack the knowledge and have not been given the opportunity of gaining an appreciation of what the world of employment requires from its workforce. However, with increased schools-industry liaison, this situation is changing.

Teachers in Craft, Design Technology departments in schools appear to be adapting to new technologies and are concentrating less on the traditional craft skills. There are still, however, woodwork and metalwork teachers who put great store by those skills, though the new breed of technology teachers see their role as providing their pupils with a broad view of technology and engineering, and experience of a wide range of materials and equipment. This change in approach is illustrated by a technology teacher:

> "... the exam taken should be design-based and not traditional Woodwork or Metalwork. The grade achieved should give a measure of the candidate's aptitude for a future in Engineering... success in these exams should not be seen as a measure of skill in handling tools and equipment".

Many teachers saw their roles as encouraging pupils to develop problem solving and design abilities rather than specific engineering skills which they feel is the domain of specialist trainers. This view was expressed by the Head of Technology in a comprehensive school.

> "The primary function of any school-based course whether it be 8-12, 12-16 or 16-18 must provide the young person with a structured approach to logical thinking and an insight into problem solving. It is <u>not</u> the function of any course to train specifically <u>for</u> any branch of (engineering) ... I prefer to encourage young people to think more in terms of designing, evaluating and analytical skills".

This view of technology in schools as the foundation to career in engineering rather than specific skill training was echoed by other teachers:

> "(I see) GCE and GCSE courses over the whole field of CDT as merely general preparation for careers in Engineering rather than specific training".

and

> "There is no real attempt in schools to train pupils for a specific career. Industry is able to do that much better as they have better resources, facilities and knowledge of specific requirements. They will also have more up-to-date equipment and be familiar with the newest processes. Schools do not have the resources needed to update equipment or experiment with new processes ... Industry could help much more with keeping teachers up to date".

On the whole technology and engineering has had a poor image which has been reflected in its status in schools. Craft courses have been considered better suited for less able students, who are thought to be "better with their hands". The assumptions which separate practical and academic aptitudes still exist. Thus in schools "bright" students have not been encouraged to join technology courses which are seen as "practical" but rather directed towards the sciences - which are considered "academic".

These attitudes and the physical separation of the science and technology departments within schools have meant that they tend to function as separate units. Links are however being forged especially through such areas as electronics and computing.

New initiatives in education particularly TVEI have had a marked effect on technology courses in schools. Teachers are often enthusiastic in their response to the new opportunities afforded by improved funding. Closer liaison with industry, and a greater appreciation of what employers require of young people leaving school have been identified as benefits. As expressed by one TVEI technology teacher:

> "What I do say to employers ... is that pupils involved in the initiative have experienced a different approach to education they have developed additional skills in problem-solving, personal and social development, an understanding of industry and comerce (non-job specific) through the experiential approach to the curriculum".

One advisory teacher for TVEI technology is rather cautious in his claims for TVEI:

> "My general feeling is that as yet TVEI has still to tackle the problems of industry and the needs of industry fully ... However TVEI is producing a pupil with, perhaps, more flexibility in the work situation".

With its stated commitment to equal opportunities TVEI, along with education as a whole, is attempting to encourage girls to join technology courses, and is attempting to develop strategies to enable girls to experience what is for them a male-dominated area of the curriculum.

CPVE and TVEI should improve contacts between school teachers and further education lecturers. Historically there has been competition between 6th forms in schools and FE colleges for students, which has militated against good communication. The development of consortia arrangements appears to be contributing towards greater understanding at the individual level, and aiding the development of progression routes between the two institutions.

CONCLUSIONS

The conclusions and recommendations are presented in five discrete sections:

1. `Bridging' : the feasibility of the research model

2. Bridge outlines: B1 and B2 : TVEI-related
   B3 and B5 : YTS-related
   B4 and B6 : CPVE-related

3. Overview Conclusions

4. Cost Implications

5. Recommendations

`BRIDGING' : THE FEASIBILITY OF THE RESEARCH MODEL

BACKGROUND

Any attempt to establish bridges between TVEI, CPVE, YTS and other foundation training in this area must begin by describing each type of provision in such a way that comparisons between them can be made. The fact that none of the schemes lend themselves easily to such descriptions and comparisons can at first sight lead to the conclusion that in practice specific bridging modules cannot be designed.

The plethora of new courses, the variety of provision and work experience under each scheme heading and the rapid process of modification and change within them have led to great difficulties in making generalisations about practice. It has in many cases been necessary to go back to the overall aims and objectives specified by the national bodies to establish the common ground between schemes with the same name.

TVEI and CPVE incorporate a vast range of alternative routes within them. Diversity and choice are of course an integral part of the British educational system, in which responsibility for the content and design of the curriculum has rested with the LEA, the school, college and their staff, rather than with national departments and advisers. The MSC's `TVEI contracts' with LEAs, for example, follow this pattern, enabling local initiatives to be funded through the MSC centrally provided the nationally established aims and objectives are met.

Similarly, while some consistency is apparent within YTS Engineering schemes off-the-job, the trainee's experiences in the work place are inevitably very varied, reflecting the many different specialisms and activities within the industry.

Due to this great diversity and variety, the first phase of this research was directed to establishing `working' descriptions of each type of provision, the results of which are presented in previous sections.

Assessment within Educational Courses

Given the acknowledged advantages of a system which hinges on local flexibility, providing opportunities for innovation and individual development, the need for recognised systems of assessing attainments is paramount. Demands for `national standards' of assessment have recently gained strength, with frequent reference to the educational practices of our overseas industrial competitors, and have led to reappraisals of the available assessment styles.

It has often been assumed of course that the regional examining bodies have provided these `national standards'. GCE and CSE certification has until recently been the major

universally acknowledged currency for all school leavers, and general assumptions have been made about the levels of attainment implied by success in each. Public acceptance of GCEs and CSEs as markers of `standards' of achievement has been such that they have become the only prerequisites in many cases for entry to further and higher education, to training and jobs.

However, this belief has increasingly been challenged, as the boards and their `standards' in practice differ widely. What is more, all have tended to rely on norm-referenced assessment methods designed to concentrate on selecting the most able, and offering only broad indicators as to whether actual competences have been acquired. Despite appearances, then, it is arguable that the national examination bodies have reinforced rather than tempered the diversity of both provision and `standards' in British schools and colleges.

Recent trends have led, therefore, to the development of new competence-based, criterion referenced assessments, to the more flexible style of GCSE, and to the introduction of numerous profiling systems and records of achievement. These profiles and records, though often locally devised, can potentially record and define the measurable skills which a student has acquired much more closely than previous reporting systems would allow. (In some cases employers and industrialists have been actively involved in devising profiles which include some of the skills and qualities which are seen as having particular currency when entering employment). Ironically, however, this move to create universally understood criteria of achievement has, in its early stages at least, resulted in practice in a confusing array of qualifications and records, which is causing at least some employers to lean even more heavily on the `understood' qualifications of GCE and CSE. The profusion is genuinely perplexing for both the educational and industrial worlds. School pupils will soon be emerging into the adult world with as assortment of credits including GCE, CSE, CEE, GCSE, City and Guilds, BTEC, RSA, CPVE and PVP (See footnote) with, additionally, various profiles and records. There has been little opportunity for anyone to become `comfortable' with any of the new schemes and qualifications, and `definitions' relating to assessments and accreditation current within technology education and engineering have been found to be at least as hard to pin down as generalisations about course content.

RESEARCH STRATEGIES

In drawing up recommendations for bridging, representatives from schools, colleges of further education, the EITB and company training schemes were asked to examine technology and engineering courses, and training programmes, with particular reference to the degree of overlap between courses, and the

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* the new joint BTEC/City and Guilds Pre-Vocational Programme for students of 14-16 years old.

feasability of developing bridging modules in order to maximise a students experience when transferring from one stage to another. Recommendations from these representatives were often made in the form of reports (for an example see Appendix 5), and a seminar was arranged to discuss bridging possibilities. A tape recording of these discussions was made, and this forms the basis of the bridging outlines described later in this section.
Because of some of the difficulties of definition and description outlined above, particularly concerning TVEI, CPVE, and the work experience element of YTS, certain strategies have been adapted in the research, and certain constraints acknowledged. These strategies have been adopted to enable generalisations to be made and likely progression routes to be considered. Without them, the basic research model could appear to founder on the rocks of diversity alone. It is therefore important that they are stated before the general conclusions about the feasibility of the bridging model are outlined.

The strategies are:

(i) In considering the progression routes outlined in the model consideration has had to be given to the likelihood of student uptake. In some cases, a bridge which is theoretically possible is practically unlikely due, for example, to a mismatch between required and attained formal educational qualifications. Although assumptions about likelihood cannot always take into account local employment trends a `common sense' position has been adopted about the probable routes which any individual will take ie. it has been assumed that occupational training aspirations and opportunities are likely to be shaped by the formal educational qualifications which a student or trainee possesses.

A distinction has been made, however, between routes which are genuinely impractical and those which would be possible, but unusual. In the latter case, the bridge potential has been explored.

(ii) Questions of vocational commitment have had to be addressed.

The assumption has been made that a `YTS General' trainee will not have a vocational commitment at the start of YTS; while a `YTS Engineering' trainee will have.

Within both TVEI and CPVE, however, students have the option of following a range of courses some of which are heavily focussed on engineering, some of which barely touch on it at all. (Both TVEI and CPVE can of course be followed without any direct reference to the engineering industry). In

attempting to `define' these schemes in the bridge outlines, no simple strategy can accommodate the whole range of student experience. The working strategy which has been adopted is, however, to consider the bridge from three perspectives, to take into account the experiences of:

1. A student who is as yet relatively uncommitted to engineering, whose only relevant experience may be gained in the `core' studies which will be common to all students.

2. A student who is anticipating employment in a technological sphere, but is as yet not committed to engineering.

3. A student who is already vocationally committed, and is following a course with a strong engineering bias.

To make assumptions of this sort is in practice the only way to give definition to the engineering content of schemes with such broad aims as TVEI and CPVE.

(iii) Such a wide range of developments are planned or are in the process of introduction that the researchers have had to consider the bridges exclusively in the light of current provision, and not pre-empt the outcomes of developments which are at a planning stage. GCSE and City and Guilds 201 have however, been taken into account, as these courses are currently being taught in schools and colleges even though the students will not have entered the employment world. Even here, however, the `paper' content of courses has had to substitute for more direct experience of content and style. Where new developments are planned but the details of implementation are not clear, they have been taken into account but with clear reference to the tentative nature of the conclusions (eg. the NCVQ, PVP, BTEC First Award).

CONSTRAINTS

Consideration needs to be given to certain basic constraints which at present inhibit the bridging process. It is in the light of these that many of the project's recommendations are made.

These constraints have also indirectly limited the scope of the research itself on occasions, representing as they do practical `blocks' to inquiry.

(i) With any innovation (such at the introduction of TVEI or CPVE and the extension of YTS to two years) there is a time-lag between initial implementation and student or trainee `outcomes'. Not only does

an automatic one or two years plus have to be written in before the first cohort of students or trainees emerge, but the first year or even more is often seen as a pilot or trial period. Usually the second and subsequent cohorts are presented with a more developed course than the first intake, and quite fundamental changes may take place in the early stages. (Schemes within TVEI are seen as developmental throughout the whole pilot period and are currently going through continuous change).

Despite efforts to publicise new developments, some uncertainty about content and status is inevitable. Educational innovations in particular may take some time to become a part of trainers' and employers' procedures, as employers are often relatively passive `recipients' of students from new courses, especially in the early stages.To some extent it has to be accepted that the issues surrounding the `reception' of TVEI and CPVE into training programmes can only be resolved with the passing of time.

In research terms, this time-lag also has implications: the research team has only occasionally been able to follow through individuals who have progressed into occupational training via any of the routes on the `bridging' map. Those individuals who have done so, what is more, have in all cases progressed from a pilot scheme, and usually from a course which was at a very early stage in its evolution.

(ii) There is often a disparity between national policy and local policy. This applies, for instance, to:

a. the criteria for student acceptance onto some school courses (difficulties have been encountered within TVEI in particular in applying the `all abilities' and `equal opportunities' policies).

b. the giving of credits and exemptions between institutions for work done and skills achieved.

c. the removal of age barriers for entry to the industry.

d. the implementation of genuine standards-based training programmes to replace time-serving apprenticeships.

(iii) Contraction within the engineering industry, especially in skill surplus areas, limits the opportunities which young people have to progress into industrial training. In areas of severe contraction, the incentives for employees to undertake initial training or to consider new alternative routes to the industry are few. (Contraction can induce employers to seek methods of accelerating training, on the other hand).

(iv) Credits for skills usually necessitate a skills assessment programme. Such programmes may be costly, however, especially where expensive machinery is involved and the assessment is individualised. Where assessment cost exceeds training cost, financial considerations may outweigh other benefits. Profiles and records, which might be used to focus assesments, are not always either kept or used.

(v) Competition for students/trainees of 16+ between schools, colleges and (especially in skill shortage areas) employers may inhibit genuine efforts to create progression routes.

BRIDGE OUTLINES

B1 AND B2 : TVEI-RELATED BRIDGES

BRIDGE B1 : TVEI INTO INDUSTRIAL TRAINING

TVEI is a four year programme, which tends in practice to be divided into two phases: one concerned with the 14-16 age group and the other, the 16-18 age group. The 14-16 phase of TVEI provides opportunities for pupils to gain broad experience of the new technologies and appreciation of the "world of work" the 16-18 phase provides a wide variety of courses including prevocational courses, as well as specialized courses for the vocationally committed.

At its introduction, it was envisaged that pupils entering the course at fourteen years old would continue through the 4 year programme. In practice young people are choosing to leave the course at different stages: at 16+, at 17+ or at 18+. Thus students entering engineering training courses from TVEI may have widely differing experience and skills. It is therefore appropriate to deal with each of these `exit points' separately.

When considering bridging from TVEI courses into industrial training, it is necessary to take into account a number of factors:

(1) TVEI has only been in existence a relatively short time, and there are relatively few individuals with experience of TVEI who are progressing into engineering. As these numbers increase and employers and trainers become more aware of TVEI, possibilities arise for the prior experience of trainees to be taken into account when planning courses.

(2) TVEI is not a course in its own right but covers a wide variety of courses, which are certificated by a large number of examining bodies. Courses in technology and engineering reflect this variety.

(3) As TVEI pilot schemes develop, the courses are evolving - courses are being adapted and modified in light of experience and the results of national and local evaluation.

TVEI PROGRAMMES IN GENERAL

TVEI describes an approach to teaching and learning rather than indicating precise details of the content of a course. Students are following courses leading to nationally recognised qualifications: CSE, GCE, BTEC and C&G many of which were in existence prior to the introduction of TVEI, although a number of courses were specifically designed to meet the aims of the scheme. The courses aim to be relevant to the world outside school, and it is in this context that the pupils gain awareness and appreciation of the "world of work". Thus TVEI courses provide, as is expressed in its aims, "a bridge from education to work".

An important feature of TVEI schemes, particularly when considering bridging, is the individual student profiles which are compiled throughout the programme. During the course of the TVEI programme these are intended to be formative in nature and develop in consultation between student and teacher; whilst on completion of the programme a summative profile is compiled recording the student's achievements. At present there is no standard format for TVEI profiles.

TVEI at 16+ into Industrial Training

When viewing the ways in which TVEI may bridge into engineering training at 16+, it would be appropriate to consider the general and specific skills separately:

(A) The TVEI Core - general skills and qualities developed in a TVEI programme which provide preparation for employment, and in particular may apply to engineering.

(B) Technology/engineering courses - more specific vocational skills which are directly relevant to a career in engineering.

A. The TVEI Core

The TVEI programme aims to develop in pupils more general qualities which are appropriate to the "world of work" and thus it is hoped will provide a pool of more employable young people. The following have been highlighted as aspects of TVEI which may be directly relevant to a career in engineering:

(1) **Problem Solving**

Pupils are encouraged to take a broad perspective when faced with problems and explore a range of solutions eventually evaluating the outcomes. This approach is developed in a range of curriculum areas, and is expected to lead to the development of problem solving skills. In engineering training schemes emphasis has been placed on problem solving skills and the ability to communicate ideas, which are compatible with TVEI aims.

(2) **Work Experience**

The TVEI schemes require that all students have experience of the work environment through work experience schemes involving a minimum of two weeks in a company. This provides the young person with a general appreciation of the work environment, and should help them to gain an understanding of, for example, time keeping, the working day, behaviour in the workplace and safety procedures. Some young people will have the opportunity of work experience in an engineering company, and therefore gain an awareness of the way in which engineering skills which they may have learnt in school are used in the work situation.

(3) **Group Activities**

Traditionally school courses have tended to concentrate on individual work, whereas many TVEI courses have encouraged group work. The ability to function as a member of a team provides experience of the type of situation found in the working environment.

(4) **Information Technology**

Central to all TVEI schemes is the development of skills associated with the use of computers in a wide range of situations. Thus Information Technology is becoming a core subject in schools. With the development of computer aided engineering these skills are becoming essential to all prospective engineers.

(5) **Personal Qualities**

The TVEI programme places emphasis on the "development of initiative, motivation and enterprise" in young people. Pupils are encouraged to take responsibility for their own learning and they gain confidence. These personal qualities often are those which are most highly valued by employers.

B. TVEI Courses in Technology and Engineering

As previously explained, there is no national TVEI course leading to a TVEI certificate but existing GCE, CSE, and C&G courses are used to provide the course content, which meet the TVEI criteria. Within TVEI there is an emphasis on acquiring a broad appreciation of processes rather than detailed specialist knowledge. The developments in TVEI echo those occuring in curriculum development in technology: moves away from specialised craft courses for example woodwork and metalwork towards broader based technology courses. GCSE courses which commenced this year reflect this curriculum development.

There is a wide range of school technology courses available for 14-16 phase, which may provide a basis for a career in engineering, and consequently young people who wish to enter engineering training will have a wide variety of experience. Although courses may have differing content and a variety of titles for example Design and Realisation; Design and Communication; Craft Design Technology and there are some common features which can be drawn out:

- emphasis on design
- the ability to communicate ideas
- computer awareness

All courses aim to develop awareness of industry and of computers. Most of the courses have a project component. Some TVEI Schemes have incorporated Electronics courses into their programmes. On the whole these have been found to have been rather too specialised and to concentrate on theory

rather than practical skills. As schemes evolve there has been a tendency to include electronics in technology courses rather than as an entity in themselves.

The aim of TVEI courses for 14-16 year olds is to raise interest and awareness of engineering rather than to train in specific skills. However the courses may provide opportunities for developing engineering skills, and these could form the basis of exemptions onto engineering training courses.

When considering the bridging possibilities afforded by these TVEI courses, it may be appropriate to consider them under two headings:

1) Core Content of Technology Courses

2) Specific Engineering Skills

1) **Core Content of Technology Courses**

It may be appropriate to recommend that all pupils who complete technology courses at 16 and wish to enter engineering training have the same basic attainments. Thus it would be necessary to suggest additional topics to be included in courses which employers and trainees consider to form essential background for engineering training:

- an experience of design drawing projections (emphasis is placed on 3rd angle as used by industry as opposed to the 1st angle projections which is commonly used in schools)

- an understanding of safety procedures when using equipment

- correct usage of machines and tools

- graphicacy - an appreciation and understanding of symbols used within engineering

- imperial/metric conversions (as some industries are still using imperial measurement)

(2) **Specific Engineering Skills**

TVEI courses in technology and engineering can provide experience of specific skills which could provide the basis for exemptions when entering engineering training courses-specifically EITB Basic Engineering Training Parts 1 and 2. These exemptions depend not only on the type of school course but also on whether the engineering training was at craft or technician level. It is therefore appropriate to treat each separately:

TVEI into Craft Training

The EITB has made provision for exemptions to be given if a trainee can exhibit competence to the appropriate level when entering the Basic Engineering Training, and in fact the first week of training is a period of assessment to establish this previous experience.

In 1980-81 a pilot scheme was set up to explore exemption possibilities into engineering training and instructors were asked to check a trainee's prior experience and then to give exemptions as far as possible. The instructors found it difficult to implement such a scheme due to the variability of the trainees, and reported that it took just as long to assess a skill as it did to teach it.

The resultant situation is that, on the whole it has been easier to treat trainees as a group rather than give individual exemptions which create organisational problems. It is envisaged that only when there are sufficient numbers of trainees who have had similar experiences can exemptions be given.

In order to give exemptions within practical engineering for skills gained on school courses it is essential that those skills can be identified precisely, and that they are measurable to a standard as specified in EITB training schemes.

GCE and CSE courses which pupils are following at present do not appear to give sufficient details of the engineering skills acquired and thus cannot provide, without further assessment, evidence of competence in those skills. The only opportunity for an exemption system to function is when a training centre is familiar with courses run by the schools from which their trainees come.

However, some of the newly developed GCSE courses on which the first pupils are embarking this year, provide more details of precise skills and thus give opportunities for exemptions onto Basic Engineering Training Parts 1 and 2. This could therefore lead to the development of "bridging units" in those skills which have not been covered by the school course.

TVEI into Technician Training

In the technician training in engineering, the EITB requires that a trainee has "a broad appreciation of processes and practices which are common in engineering as a whole", but does not necessarily need to have practical experience of skills to specified standards. Thus school technology courses may provide the required basis for exemptions into the Basic Engineering Training.

Pupils who intend to enter technician training are those who have followed GCE courses. In these courses emphasis is placed on "design and make" where a design problem is posed and pupils suggest a solution and select appropriate materials in which to construct a model. The aim of the exercise is to explore a problem rather than produce a beautifully crafted finished product. The pupils will be expected to produce a record of their work and details of the different solutions they have attempted. This emphasis on problem solving and communication are elements which are relevant to technician training.

A further skill required by technician trainees which is not required to the same extent by craft trainees is the ability to carry out design drawings. As this is an essential component of recent GCSE courses, here is a further opportunity for exemptions onto basic training.

As with craft training, bridging units could be developed which provide experience of practical skills not covered in school courses.

BRIDGE 2 : TVEI AT 18+ INTO INDUSTRIAL TRAINING

TVEI pupils at 16 have a number of options:

a) to continue the TVEI programme into the 6th form in school and/or tertiary or FE College.
b) to leave TVEI but follow non TVEI courses in the 6th form
c) to leave school and join a non TVEI course at a College of Further Education
d) to leave school and join a YTS scheme
e) to enter full-time employment and possibly join a training scheme

If the student decides to continue a TVEI programme, he, or she, may opt for a one year or two year course.

A common route for those following a one year programme is to join a CPVE course and then leave school at 17. For those students who decide to enter a career in engineering this will mean joining an engineering training scheme at 17. This is discussed in Bridges B4 and B6.

Students who have decided to follow a two year course in the sixth form and who are interested in the field of technology engineering may follow a variety of courses. Those students, who hope to enter university and obtain a degree in engineering, will need to comply with usual entry requirements of A Level Maths, Physics and Chemistry, and thus may not follow an A Level Technology course. However, those who wish to enter engineering at 18, may decide to follow an A Level Technology course. As with O Level the content of these courses can vary greatly although they will have common components: the theoretical background to engineering and a major project which composes 20-40% of the final examination mark. Students at the end of their course will have achieved some practical engineering skills to a high degree of competency and have a degree of understanding of engineering well beyond the basic engineering training requirements. This naturally provides a case for exemptions into technician training, which this type of student would tend to join, and creates an opportunity for "topping-up" in the practical skills they have not acquired - these could form the basis of bridging units.

A further aspect which A level students will need to cover, is the work-based experience aspects of engineering. This too could form a bridge in the form of a work experience package.

A number of 16-18 TVEI programmes include BTEC engineering courses, which may be provided in Colleges of FE, and here the progression routes within BTEC are clearly defined, although there may be a mismatch with the student's practical experience and company specific requirements.

At present there are no students who have completed a 4 year TVEI course, - the first students from the initial TVEI schemes are only now commencing the last year of their 4 year TVEI programme.

OVERALL BRIDGING IMPLICATIONS FROM TVEI

When bridging, from TVEI into engineering training it is essential that students' skill attainments in school are compatible with that required by industry so that exemptions may be given, and appropriate bridges be designed. There are a number of ways in which the students' experience may be recognised:

1. **Syllabus Details**

The school syllabus would need to provide exact details of the standard of competency within each skill.

2. **Records of Achievement**

Accurate and detailed records need to be kept of each individual's achievements. All TVEI schemes are required to provide summative profiles at the end of the student's TVEI programme.

3. **Initial Assessment**

Before entering engineering training, assessment could establish the student's competence in the relevant skill areas.

Once there is a clear picture of the student's competence and capabilities an appropriate bridging programme could be designed.

PROVISION - RELEVANT TO ENGINEERING	POSSIBLE FURTHER REQUIREMENTS FOR OCCUPATIONAL TRAINING	BRIDGING POSSIBILITIES
TVEI Core - information technology - work experience - problem solving skills - group activities	Safety Imperial/Metric conversions Design drawing Competence in use of machines and tools Cutting heads and feed times	Initial testing Graphicacy Use of CNC equipment Basic electronics
Technology CDT - background - raise interest - project work - computer awareness		
Electronics - background - symbols - basic skills		
C&G 686 - basic skills - interest		

ISSUES

1. Role of school courses as preparation for engineering training
2. Variability of course provision
3. Industry's input into the school curriculum

PROVISION RELEVANT TO ENGINEERING	POSSIBLE FURTHER REQUIREMENTS FOR OCCUPATIONAL TRAINING	BRIDGING POSSIBILITIES
BTEC to engineering AL Technology - skills - theory - project work - problem solving	- further practical experience - work based experience	Initial testing Local exemptions Basic skills as required

ISSUES

1. AL Technology in vocational training
2. Variability of course provision
3. Industry's input into schools

BRIDGE OUTLINES

B3 AND B5 : YTS-RELATED BRIDGES

BRIDGE B3 : `YTS GENERAL' TO `YTS ENGINEERING'

The definitions of `YTS General' and `YTS Engineering' outlined on pages 30 and 31 have been adopted in looking at the possible content of this bridge. A `YTS General' trainee will:

- not have made a vocational choice at 16 to enter engineering

- not necessarily have gained any experience relevant to a career in engineering outside the YTS core outcomes.

In practice, the trainee may therefore have very little in the form of occupational skills which could constitute `credit' within an engineering sphere, in which case the content of this bridge could simply be defined as whatever `engineering' work was contained in the receiving `YTS Engineering' course.

However, a trainee may acquire some or a number of engineering skills and relevant industrial background up to a point where they could be matched against the training specifications of a YTS Engineering course which was, say, based on the EITB Craft or operator scheme, and there is perhaps even more potential for overlap with company-designed operator training.

The skills/relevant background will have been acquired largely within work experience, which may, for example:

- have included work within an engineering environment, possibly operating machinery

- have included work within an engineering organisation, but away from the manufacturing process, eg. clerical work, stockhandling/warehousing

- have included simple servicing tasks or the assembly of components.

There is very little standardisation of the content of the on-the-job component of YTS training, even within engineering schemes, so it is literally impossible to draw up guidelines which would enable any generalisations to be made about the transferability of skills gained in this way within as specific an area as engineering. However, some examples of transferability might be:

- familiarity with engineering technology

- familiarity with machinery, tools and their functions

- familiarity with safety regulations within the industry

- the ability to operate specific machines or a range of machines

Acquiring a basic familiarity with the engineering environment is an important part of the early stages of all forms of engineering training, so familiarity acquired through close contact with the industry should represent genuine `credit' in more specific training, although it is at present difficult to see how this could be managed except within the company or training organisation.

Specific skills with a clear, measurable credit value can also be acquired, however; and a trainee may on occasions be acquiring skills up to the levels necessary to qualify for exemptions within the EITB craft framework. More likely however, (s)he will be operating machinery for which there is a relatively short training time, which could overlap with the content of an operator training programme, and may be transferable either within the company or across the industry. Exemptions could in this case be based on formal or informal assessments dependant on context.

Bridging Implications

Because of the minimal nature of the specialised engineering knowledge or skills likely to be acquired in this type of YTS, it is not possible to construct realistic bridges into any of the higher skill training areas. If progressing to technician training, eg., the trainee would effectively be starting again as if (s)he had no knowledge of the engineering environment. There may be some area of overlap with Craft Basic Engineering Training, but in most cases it would be minimal. The greatest potential for overlap would be within operator training, though there may also be none here.

As any skills acquired will be within work experience, it is particularly important that placement supervisors and managing agents maintain records and reviews of on-the-job activities and achievements. Individual bridges, where appropriate, can only be constructed with reference to such records and to specific skills assessments. Where the relevant skills acquired are likely to be few, it is probably not financially viable for most employers and trainers to conduct a full skills assessment programme to identify those which have been gained, and the onus is therefore on the YTS monitoring staff to ensure that the work experience activities are recorded in a way which will transfer to a `receiving' training programme.

B3 : YTS General to YTS Engineering

LIKELY ENGINEERING RELATED EXPERIENCES WITHIN YTS GENERAL	LIKELY CONTENT OF BRIDGE REQUIRED TO ENTER YTS ENGINEERING
1. YTS Core Comp	1. Off-the-job Engineering work (eg. EITB Basic Engineering Skills) Minus Skills acquired in work experience
2. Work Experience, (which could contribute to an Appreciation of the Engineering Industry or Basic Engineering Skills acquisition)	2. FE related to Engineering (usually City and Guilds)

ISSUES

1. Engineering content, variable in YTS General (and could be minimal)
2. Importance of monitoring and recording work-based achievements in YTS General

BRIDGE B5 : YTS ENGINEERING INTO 'APPRENTICESHIP-EQUIVALENT' OCCUPATIONAL TRAINING

The definition of 'YTS Engineering' used here is that outlined on p.20. The trainees's status and experiences are likely to be as follows:

- non-selective recruitment to scheme
- non-employment status within work experience organisation
- minimum YTS period off-the-job (13 weeks first year; 7 weeks second year)
- off-the-job provision based on City and Guilds level 1 (usually 201 post-86) and/or Parts 1 and 2 of EITB Basic Engineering Training (BET) or close equivalent
- destinations within engineering operator or craft training and employment

OFF-THE-JOB PROVISION

Despite marked variations in the nature of work experience, there is a consistent pattern within the off-the-job work and in practice most trainees will do at least the equivalent of EITB Broad-Based Basic Skills in their first year, usually using the EITB skills checklist. Occasionally City and Guilds will be used as the framework for these basic skills; more usually, however, City and Guilds will either be used as a parallel course to complement Basic Skills Training (as it would be in apprenticeships or the recommended schemes) or will take up the 7 weeks off-the-job in the second year. The main alternatives therefore are:

1	2	3
1st year BET	BET & City and Guilds	City and Guilds Level 1
2nd year City & Guilds Level 1	BET & City and Guilds	City and Guilds Level 11

Craft Trainees

All of these alternatives cover some of the off-the-job work which a trainee on a `recommended' craft scheme would cover. In theory at least it should be possible to identify the areas in which the trainee will need `topping up' with off-the-job provision by simply eliminating the common ground between the two schemes and seeing what remains. For a `craft' trainee, eg.

TYPICAL 'YTS ENGINEERING'	TYPICAL EITB CRAFT TRAINING
City and Guilds EITB Parts 1 & 2 BET	City and Guilds/BTEC EITB Parts 1 & 2 BET
(work experience)	EITB Parts 3 & 4
City and Guilds/further BET	City and Guilds/BTEC
(work experience)	In-Company module segments

NB. The boxes need not represent blocks of time. Course components could be eg. day-release.

'Top up' module content

Operator Trainees

For an operative trainee, the picture is not quite so straightforward in theory (due to the very varying patterns of operator training encountered in the industry), but progression may be more straightforward in practice, as this type of YTS scheme is frequently very similar - even in detail - to the standard operator training programmes which existed prior to YTS.

Different issues arise here, relating to the relevance of broadly-based craft training to operator jobs in those organisations which focus closely on one or a range of specific skills. It may be that more consideration needs to be given to the identification of specific transferable `operator' skills which could form the basis of a separate off-the-job programme: craft skills may not in practice be an appropriate engineering base for operators who wish to progress within an employing organisation. The present concentration within YTS on `off-the-shelf' craft schemes may be equipping trainees with inappropriate skills and also failing to acknowledge those specific skills which operators acquire at present largely on-the-job.

The new EITB/YTS operator scheme was not used in any of the schemes within this research, but its development and publication may help to standardise training practice if and as it becomes an established model.

There are also indications that some types of operator training can best be conducted outside YTS. The YTS framework assumes that training will be broadly based with later specialisation, while most operator training builds on a single skill (which may take anything from an hour to 18 months to acquire). Craft training, therefore, conforms to the YTS pattern while operator training in its present form tends not to, even though a highly skilled operator will have many skills in common with a craft colleague. The difference can be represented diagrammatically using the idea of a training pyramid:

Careful consideration needs to be given to the suitability of adapted craft programmes as preparations for operative jobs.

WORK EXPERIENCE

Most of the trainee's time will be taken up with work experience and on-the-job training, which may take many forms. However, it is important that this experience is not disregarded when constructing a `top up' module into a craft apprenticeship or recommended scheme traineeship. Experience may be highly relevant to both craft and operator work, and the necessity to keep records of what has been done is essential, as skills can often be acquired more fully in the industrial environment than in the training workshop.

The reviewing and recording of progress within on-the-job placements takes place at two levels: in the workplace, by the placement supervisor; and by the managing agent at regular intervals. It is particularly important that full records are kept at both levels in such a way that they can be referred to by off-the-job training or FE staff at a later stage. In practice, the records may only provide an indicator of areas in which further skills assessments could be made, but the assessment process itself can be made much more efficient by being focussed in this way.

Where records are not kept and full skills assessments are not undertaken, attempts to work out a `rule of thumb' equivalent between on-the-job and off-the-job training do not seem to meet with success. A 2:1 ratio of `time spent' has been used in the past and is still used in certain contexts, for example, with adult craftsmen. However, this appears to disadvantage the YTS trainee whose on-the-job experience may be less substantial than the adult's. (In one example encountered, a trainee with 36 weeks on-the-job training was recruited by his placement company, who, wishing to advance him to full apprentice status as quickly as possible, used the 36 weeks as the basis of a 12 weeks exemption from skills training. The trainee in this instance seemed to be severely disadvantaged and was unable to make up the `lost' skills training time).

With the development of the NCVQ framework, and the proposed development of scales of work-based competences, the pressure will probably increase for placement supervisors and work providers to become more actively involved in record keeping and reviewing and there are clear signs that more precise definitions of on-the-job achievements will be established on a national basis.

BRIDGING IMPLICATIONS

Craft

For trainees entering craft jobs, the content of a module which would bridge into full craft training could be arrived at by subtracting those skills already achieved from the full craft training programme. Given suitable back-up assessment methods and on-the-job progress reviews, the module could be delivered in a training centre using available materials, and at whatever point of the programme the trainee's sponsoring company decided.

Bridging of this type is already conducted by the Training Board in individual cases, where a company is prepared to sponsor it.

Certification

Although the content of this bridge should be clear cut there seem to be practical problems relating to the accreditation of trainees who have done YTS craft courses and who proceed into the industry as apprentices.

At present EITB Basic Engineering Training which takes place within YTS but outside the recommended framework - eg. where skills for Parts 1-3 have been achieved to standard over two years rather than over 36 weeks in the training centre- these are not automatically acknowledged for certification purposes by the training board. A certificate may be issued, with the back-up of separate assessments if considered necessary. Without a certificate, trainees cannot, however, progress formally to in-company module sgement work.

In practice, many trainees seem to be disadvantaged by the necessity to make a specific application for certification in this way. Many employers are assuming that the YTS off-the-job work has automatically `earned' Basic Skills recognition and are proceeding with the equivalent of in-company specialist (segment) training; some employers have been assuming that first-year off-the-job provision alone qualifies the trainee for module segment work. This in-company training is clearly unregulated by the training board and in many instances is taking place in companies out of scope to the EITB for reasons of size or product. However, the programmes in many instances will result in the trainee acquiring more specialised craft skills within what (s)he and the company are assuming to be an apprenticeship, even though no recognition of skills is being given through the training board.

The trainee may be disadvantaged in two ways:

1. where recruited after a year of YTS, the first level of specialisation (Parts 3 & 4) may be omitted from the training programme, which jumps from Basic Skills to segments.

2. skills acquired to a specialised level are in effect remaining unrecognised because of: (i) their acquisition initially within a YTS framework and/or; (ii) the circumstances of individual employing companies.

In theory, these are not insoluble problems: exemptions from initial training can be given to adults who can display that skills have been achieved to a more advanced standard; and the EITB `Parts' can even be accredited when taken out of the inteded order.

However, in practice many trainees are not being accredited despite apparently acquiring suitable skills because of the difficulties encountered in gaining certification for this type of scheme.

It may be that some clearer guidelines need to be established which both safeguard standards and allow a little more flexibility within the YTS route.

Operator

It is not possible to be very precise about bridge content within operator training. Frequently there will in fact need to be no bridge, either because:

- there is an exact match between YTS provision and full operator training already

or

- operator training is too specific to be compatible with YTS provision

At present YTS training for operator work tends to be based on craft skills; it may be that the recent development of a specifically operator-oriented programme by the EITB may help to focus YTS in this direction and will in itself provide the necessary bridge to employment and further training.

B5: YTS Engineering into Apprenticeship-Equivalent

LIKELY ENGINEERING-RELATED EXPERIENCES WITHIN YTS ENGINEERING	LIKELY CONTENT OF 'BRIDGE' REQUIRED TO ENTER OCCUPATIONAL TRAINING
(EITB-type) Basic Skills Training City and Guilds Work experience	CRAFT Basic Skills Training up to EITB Part 4 or equivalent and compatible City and Guilds/BTEC Minus Skills/relevant experience already gained OPERATOR No bridge necessary

ISSUES

1. Importance of monitoring work-based achievements in YTS Engineering, to establish 'credits' for skills and knowledge gained within work experience.
2. Importance of maintaining records of achievements within off-the-job provision.
3. Practical difficulties in accrediting trainees was transfered to 'employed-status' apprenticeships.

BRIDGE OUTLINES

B4 AND B6: CPVE-RELATED BRIDGES

BRIDGE B4 : CPVE INTO OCCUPATIONAL TRAINING

It must first be noted in this section that there is a level of uncertainty about future developments in CPVE which make the CPVE bridges more tentative than the others. The particular factors which contribute to this uncertainty are:

- that CPVE is at an early stage in its evolution. Progression into YTS and/or employment is currently under consideration at local and national levels, with many open questions acknowledged and as yet few established pointers.

- that engineering/technology vocational work is done by only a minority of CPVE students.

- that a very wide range of approaches may be used within CPVE, and a very wide range of students catered for.

In order to accommodate at least the last of these factors, three possible `student profiles' are used below to illustrate both the possible CPVE range and the ways in which occupational aspirations relate to the choice of a CPVE course and the implications it has for progression.

STUDENT WITH LITTLE VOCATIONAL COMMITMENT

A student with little vocational commitment will be assumed to have attained an acceptable level in all CPVE `core' areas by the completion of the course, and to have done a `taster' in engineering - probably an introductory vocational module. No assumptions are made about previous school attainments except as they relate to the formal entry requirements of specific training courses.

(i) Core Studies. A minimum level of competence is assumed in all 10 core areas, whether acquired pre-16, within GCE or CSE work done within or outside CPVE post-16, or in an integrated way within vocational CPVE work.

`Core' achievements may be accredited through the CPVE external assessments (of which as yet only numeracy and communication are available).

The core studies which may particularly impinge on engineering are:

Industrial, social and environmental studies, Science and Technology, Practical and problem-solving skills.

(ii) Introductory Engineering Module. This will give a broadly-based introduction to the industry, its employment needs and role in society, and sometimes some basic manual skills. Modules are normally devised within the scheme, but the skills component where taught may be loosely based on

nationally recognised programmes (eg. quite commonly parts of First level City and Guilds courses are used).

Bridging Implications

Assuming that the student develops a vocational commitment during the course, this type of CPVE provision would facilitate progression to occupational training in fairly general ways eg.

- by increasing confidence

- by strengthening vocational commitment

- by `topping up' on `core' areas such as numeracy, communication and problem-solving skills, knowledge of technology and computing

- by introducing the industry and familiarising the student with its requirements.

It would be unusual nonetheless for basic engineering skills to have been acquired to a level where `credits' could be given in FE or on training programmes.

Students who had followed this type of CPVE course would have the advantage of a basic grounding in engineering. This might be especially beneficial at interview or in seeking employment within the industry.

It would also be a highly suitable background for say, operator training in the industry, where the usual pattern assumes no specific prior qualifications and exclusively in-company training (though City and Guilds day-release may be appropriate). Most employers and trainers see commitment and motivation as the main prerequisites in this area. Some employers, however, may be unused to recruiting operators at 17, and this may marginally disadvantage CPVE graduates.

Students seeking employment or training in craft areas will normally be assumed to have some relevant CSE or GCE qualifications (which may of course have been acquired pre- or post-16). Given that there is a basic match between these formal attainments and any pre-specified entry criteria for the craft training scheme, the same comments apply as above. However, the age of the CPVE graduate may be a greater disadvantage in recruitment to craft programmes, as the apprenticeship traditions allied to the `wage for age' agreements are strongest at this level.

Fewer students with aspirations to technician jobs would in practice be likely to take this type of CPVE course. If those who did had already acquired the formal academic entry requirements usually attached to technician training (4 `O' levels or equivalent) pre-16, the course would be chiefly beneficial in informing choice and strengthening commitment

as above. The CPVE year may also, of course, enable the student to retake say, `O' levels which would allow access to technician training.

The picture relating to this particular part of the bridge is, then, relatively straightforward. The student should not suffer from `overlap' (at least not specifically tied to the CPVE provision); few credits would need to be made; and skills assessment would not be necessary.

Students would enter directly any scheme which had a `fresh start' policy (in practice most do). Craft apprentices may, however, be seen as having `lost a year' in some schemes which normally recruit at 16.

STUDENT WITH SOME VOCATIONAL COMMITMENT

Given that the CPVE framework is designed to be responsive to individual student needs (particularly to those needs relating to the process and timing of making vocational decisions), it is particularly important to define the type of student who is following any CPVE course before discussing any of the issues relating to it.

In practice the student with `some vocational commitment'- for whom engineering is the likely but not the necessary destination - would be the mosty typical type of CPVE student. Engineering is not commonly taken as a `taster' option (as described above), and CPVE itself is not intended for the vocationally committed (though some courses do in fact assume a much higher level of commitment than others- these are discussed below).

The `middle ground' student with an interest in an engineering career will have most or all of the following characteristics:

1. Basic commitment to work within technological occupational areas

2. Choice of engineering as likely destination

3. Desire to delay occupational choice while retaking GCE, CSE, CEE exams (especially if success in these is a basic qualification for any of the likely occupational areas).

4. Reluctance to make final occupational choice without experience of the industry (especially applies to `late deciders' who may have done little technology-focussed work in school and/or have had no real contact with the industry. Some girls in particular may wish to make a late vocational choice on the basis of local employment opportunities).

Although CPVE can take many shapes for this type of student the main `strands' of the course are likely to be at present:

(i) `Vocational Studies' in the form of City and Guilds and/or BTEC components
(ii) CPVE preparatory modules, devised by the Joint Board (though as yet not as widely used as City and Guilds and BTEC modules)

(iii) locally-devised modules to reflect interest/local needs etc.

(iv) Retakes to improve grades in GCE/CSE

(v) Work experience

(vi) `Core' studies (either integrated or separate)

Each of these strands represents some form of `credit' for a student wishing to progress into training or employment and each will be considered separately below as part of the overall progression picture.

(i) **Vocational Studies based on City and Guilds and BTEC**

There is a strong likelihood that the engineering student will:

(i) take the vocational studies part of CPVE within a college (even when it is a consortium scheme), and

(ii) follow a course based on published `Level 1' curriculum outlines devised by City and Guilds or BTEC.

The City and Guilds and BTEC courses can be used `neat' or in various combinations. They are, for instance, commonly used:

- as predefined `unit modules' run in parallel with a separate core
- as a base from which modules can be extracted, omitting as necessary
- as sources of standard material which can be integrated either with other `standard' material or with the `core' to form separate modules.

They can also be used at each of the three module `levels' (introductory, exploratory, preparatory), though the following patterns predominate:

Introductory: usually locally devised but can be based on introductory City and Guilds (from 1986, normally the first parts of CGLI 201)

Exploratory: City and Guilds (201 and other Level 1); BTEC Standard Units (Exploratory work is often project-based, so tends to focus on the assignment work).

Preparatory: Complete Level 1 courses within City and Guilds and BTEC.

It is not necessary to discuss here the detailed content of these - published - schemes, or to look at the many possible ways of merging and combining them. (One course which combined BTEC and City and Guilds is described in the Poole case study). However, the inclusion of recognised courses of this sort has major implications for progression which are discussed below.

Bridging Implications

The inclusion of recognised FE courses within CPVE is at present seen as the main way of ensuring progression to training, largely because most employers and industrial trainers are as yet unfamiliar with CPVE (See Employer Attitudes p.oo), and the names of City and Guilds and BTEC are seen as having a tangible `credit' value. In view of the RVQ's conclusions that even the established FE System `appears complex and difficult to understand to industrial users' it is hardly surprising that new forms of credit such as those represented by the CPVE core and preparatory modules have not yet been generally acknowledged as `hard currency' in the industry.

The use of FE courses within CPVE, however, could create problems of discontinuity unless provision is made for them by trainers in industry when the student moves into employment. In particular, the route into craft training may need some negotiation.

CPVE to Craft Training/YTS

The new City and Guilds 201 is highly compatible with CPVE because of its competency-based approach, and seems to be emerging as one of the `standard' engineering courses. Furthermore, it is designed to complement Basic Engineering Craft Training, with which it normally runs in parallel. However, the position of a trainee who has already completed parts or the whole of 201 before entry to Basic Engineering Training is not clear. At present two options present themselves: the trainee can repeat 201 or at least some parts of it; or can start on Level 11 City and Guilds work. Neither of

these options is particularly satisfactory, however. The first leads to duplication of effort and to demotivation and is inefficient of resources; while the second causes the trainee to follow a broadly-based training in parallel with a relatively specialised Level 11 Further Education course. As the 201 is designed so that students acquire competences through practical tasks and activities which will almost certainly involve the use of basic engineering skills, the answer is perhaps in this case for a set of formal exemptions to be worked out between the new 201 and the industrially-based parts of Basic Engineering Training. There has not yet been time to establish where the overlap may occur in practice, but the recent emergence of 201 as a popular CPVE course will make this a necessary development, and there are early indications that a rough equivalence between 201 and, say, EITB Parts 1 and 2 skills would not be hard to establish. The advantages would include the development of a more natural progression into the second `YTS Engineering' year, which at present is largely seen as developing initial skills specialisations (early Part 3 work) off-the-job. (It might also contribute to the establishment of `Level 1' Status for CPVE within the planned NCVQ framework).

CPVE to Technician Training

The inclusion of City and Guilds and BTEC Level 1 units in CPVE could theoretically involve the same problems in technician as in craft training, but in practice the technician programmes are designed to accommodate a wider range of previous attainments as well as trainees of different ages, and progression ought not to be problematic. A student who has gained BTEC units on a CPVE course would normally not have difficulty in finding a route through to industrial training, given the shortage of technicians in most districts, and the training flexibility.

(ii) **CPVE Preparatory Modules**

As yet only a limited range of Joint Board Preparatory Modules are available within Engineering though more are being developed. However, there has been an apparent reluctance to use the new materials widely, possibly simply because of unfamiliarity and a sense that the `set' is incomplete, with associated feelings that a `CPVE module' has little currency in the employment world.

CPVE modules, where they are used, seem to be seen as a third `FE' alternative, in combination with or beside City and Guilds and/or BTEC units. CPVE may be seen as an alternative to City and Guilds for `craft' groups; or it may sometimes be undertaken by all students as the common Engineering foundation which complements both the BTEC/technician and CG/Craft courses. As with BTEC and City and Guilds, the modules may also be used as `base' modules which can be added to or borrowed from.

Some CPVE modules should enable at least some exemptions into (EITB-Style) Basic Engineering Training, day-release FE and full-time FE. In particular, preparatory module 9. `Engineering Drawing' should adequately cover all aspects of Drawing in Parts 1 and 2 BET, and the core segments. Module 16, Engineering Processes and 22 Fabrication and Welding could lead to exemptions being granted.

Bridging Implications

In many respects, a student who has completed a programme including CPVE modules is in a very similar position to one who has done City and Guilds 201. In practice, the student should have acquired many skills and competences required within Basic Engineering Craft Training, and also within any City and Guilds day-release courses which would complement it. Students who had planned their module programmes on the basis of a likely specialised vocational area (such as production engineering or electrical installation at craft level) would potentially be able to progress through their first training year much more quickly, and should be able to gain exemptions from much of the first year YTS off-the-job work to proceed into the second year programme with minimal `top up'.

However, difficulties arise in drawing up specific outlines for bridging modules, as the CPVE modules do not specify standards and levels of achievement in the same way that occupational training schemes do (such as eg. the EITB scheme). Instead, the CPVE `Self Assessment Profiles' would need to be used to assess individuals against the Basic Engineering Training Specifications, and individual bridges constructed.

If used to the full, the CPVE profile could in itself eliminate the problems produced by overlaps or gaps caused by transition to another scheme, by presenting an exact record of skills achieved in a way which should be compatible with that of most `receiving' training programmes. This makes it particularly important that both the student and the employer should understand how the profile works and can be used: some concern has been expressed that CPVE students themselves do not make full enough use of the self-assessment profiles when seeking employment, causing employers to disregard it or at least underuse it.

(iii) **Locally-devised Modules**

These can be wholly locally-prepared, or based on standard courses. In one college, for example, wholly locally-prepared modules are run in hydraulics and pneumatics, alongside joint BTEC/City and Guilds/CPVE provision; and additional local CADCAM material is included in CPVE module 16 `Engineering Processes'.

Bridging Implications

Given the increased necessity to acknowledge skills when they have been acquired outside an established course framework, the need to give attention to self-assessment and profiling is even more central with locally-devised modules than with CPVE modules.

(iv) **`Retakes' of CSEs, GCEs, CEEs**

Examination retakes can be taken within CPVE as part of the core or as additional studies, and are frequently offered outside the framework as parallel activities. As in other types of CPVE, they can be a vital bridge into selective occupational training schemes. In Engineering students are likely to seek improved grades in Mathematics, English and Physics, which are standardly required for many craft and technician courses. Students who have a specific occupation or training in mind may need improved qualifications in such areas as Design Drawing, Electronics, Computing etc.

Bridging Implications

There is some evidence of unnecessary overlap between technical/craft `retakes' which incorporate practical skills (often in the school part of a consortium) and vocational studies. This can be particularly wasteful of time and resources, and can also be very demotivating for the student (who is already repeating work done pre-16). School and college may need to give particular attention to this overlap on an individual basis.

(v) **Work Experience**

Work experience forms a part of all CPVE courses, and where possible those following Engineering-oriented courses will work within an engineering organisation. The work experience period is however quite short (3 weeks) and few skills are likely to be acquired though gains in familiarity/confidence etc. are likely to be important outcomes.

Bridging Implications

Contacts made in this way with employers can be a vital part of bridging to employment and industrially-based training, and follow-up studies (2) even indicate that:

> `There is some evidence to suggest that the work experience element of CPVE is crucial for progression'.

Often CPVE programmes are able to build on already `solid traditions of cooperation with local employers over work experience', (2) to create local opportunities for progression.

(vi) **Core Studies**

As in other CPVE programmes it is assumed that by the end of the CPVE year, a minimum level of competence will have been achieved in all 10 core areas. Competences may be recorded in the CPVE Profile using the CPVE `Bank' of competence statements, or may be accredited through the CPVE external assessments (as yet only available in numeracy and communication).

In some cases the `numeracy' and `communication' core work will be done without any integration within a Methematics or English `O' level, CSE or RSA framework, so will also constitute part of the `retake' or `FE' strands. Other `cores' covering, eg. Science and Technology/Information Technology/Industrial, Social and Environmental Studies, are more likely to be based on locally-devised materials, either integrated into vocational work or as discrete modules. In consortium schemes, the `core' may be separated out and covered entirely in the school, with a sharp distinction between the vocational (usually FE-focussed) college contribution and the school's.

Bridging Implications

At present, it is within the core that there appears to be the greatest variation between CPVE schemes.

However, it is on the core achievements that many of the national discussions about progression seem to be focussing, with the suggestion that vocational studies within CPVE should take a lower profile and become even more closely associated with recognised FE courses in future. CPVE `core' certification may even become an entry requirement for later BTEC courses, which could indirectly affect the route through to occupational training and jobs by allowing access to technician-level training for those who do not already have the stipulated GCE/GCSE requirements for the FE component of the course.

* * *

Overall Bridging Implications

It should be clear from the foregoing that a student following an engineering-focussed CPVE will acquire a range of`credits' of various sorts which should be transferable within engineering training.

Students should have covered not only much or most of the FE work associated with first year occupational training, but also within the new activity-based City and Guilds 201, within some of the CPVE modules and some of the BTEC Level 1 units (such as `workshop practices'), (s)he should also have covered substantial parts of Basic Engineering Training and even core segment work within the EITB programme. This results in the recent tendency for college courses such as those mentioned above to stimulate learning through practical activities, which frequently involve specific skills acquisition, but as yet there is little recognition of this overlap. An immediate priority should therefore be to formalise exemptions from the new 201 and CPVE modules into Basic Engineering Training.

The construction of individualised `top up' modules for CPVE students of this type using skills assessments is possible and, given the substantial overlap with industrially-based schemes, would be a much more economical option than starting this type of CPVE student in an industrial or training scheme `from scratch.' However, the use of skills assessments seems unnecessarily cumbersome when detailed skills profiles can be constructed within the CPVE framework which will give an employer exact details of the students attainments from which a `tailor-made' training programme can be constructed. The immediate priority here is to train students to use the profile and to explain its significance to employers, at least until CPVE has a more established position.

If a CPVE graduate could demonstrate the attainment of specific skills in this way, it would also help to clarify the position of a CPVE student who wishes to progress to the second year of a YTS course. If the profile revealed that equivalent attainments to Basic Engineering Training (Parts 1 and 2) and the FE component had been acquired, no `top up' would be necessary and further specialisations could be built into the second year. If not, the `top up' content could be easily identified.

One final point emerged from the study relating to the structure and content of CPVE itself. It seemed that there might be a danger that some of the CPVE strands overlap with each other, particularly where school and college communications are not strong. With the development of 14-16 schemes such as PVP and TVEI, there is also a possibility that many students will enter CPVE having already achieved `core' aims, so it is likely to become even more important that the programme is genuinely responsive to student needs and experiences.

VOCATIONALLY COMMITTED STUDENT

Most students who are strongly vocationally committed to engineering would in practice be counselled to take other options than CPVE. More direct routes to training or employment are, for example, through:

an apprenticeship
YTS schemes
full-time FE courses, usually BTEC Diplomas

However, individual students may choose CPVE even though they are vocationally committed, because of:

1. Failure to gain qualifications or grades needed to enter training or course of choice. CPVE enables GCEs etc. to be retaken alongside relevant occupational work and is seen as leading to full-time FE.

2. Prejudice against YTS schemes which do not include employer sponsorship.

A minority of colleges, on the other hand, offer CPVE as an option for the vocationally committed. These colleges have usually adopted the CPVE framework wholesale to replace their former foundation courses (which would normally have been based on BTEC Level 1 units), and continue to see CPVE as a more broadly-based vehicle for BTEC units, at least for some students.

Whatever the reasons for taking CPVE, a vocationally committed student will in practice combine similar strands within the programme as the less vocationally committed youngster, but (s)he will tend to do more preparatory modules, and will probably opt for those modules which have some recognised form of accreditation.

Bridging Implications

As the courses followed are likely to be similar to those followed by other Engineering CPVE students the bridging issues are also very similar.

The vocationally committed student will be more inclined to go for options within the course which have `visible' credits as the qualification levels are the bridge into employment or training for many of these students.

Where a student is making use of the CPVE framework in this way, careful consideration should be given to course content and indeed to his or her suitability for CPVE. Where the framework is simply seen as enabling failed exams to be taken again, students may find the introductory and taster work inappropriate and even demoralising. A case could be put for establishing alternative provision which would allow vocational studies and school work to run alongside each other, with a stronger potential bridge into specific categories of occupational activity.

B4: CPVE* TO YTS ENGINEERING OCCUPATIONAL TRAINING

LIKELY ENGINEERING-RELATED EXPERIENCES WITHIN CPVE	LIKELY CONTENT OF 'BRIDGE' REQUIRED TO ENTER ENGINEERING OCCUPATIONAL TRAINING
CPVE 'core' Work Experience in Engineering Project work (possibly based on BTEC/City and Guilds) 'Preparatory Modules' based on - CPVE Modules - BTEC - City and Guilds	OPERATOR No bridge necessary CRAFT AND TECHNICIAN Basic Engineering Skills BTEC/City and Guilds Minus Attainments in CPVE (Probably significant overlap requiring assessment/individually designed programme)

ISSUES

1. CPVE courses variable (Content and level)
2. Importance of recording/assessing achievements in BTEC/City and Guilds/ CPVE preparatory modules and establishing overlaps into 'receiving' courses (including particular need to compare overlap between City and Guilds 201 and Basic Engineering Training).
3. Difficulties encountered when seeking to enter the industry at craft left at 17.

* The CPVE student is assumed to have 'some' level of vocational commitment to Engineering

BRIDGE B6 : CPVE TO FULL TIME FURTHER EDUCATION

As outlined in Bridge B4, CPVE in Engineering can take many shapes. However, one of the major `strands' of those courses which focus on engineering is the use of materials from `standard' City and Guilds and BTEC programmes. Where CPVE is taken within the same college as later FE work in particular, then, `top ups' and exemptions into full-time Further Education courses can be decided on the same basis as most colleges already use (exemptions from units are considered almost as a matter of course for each BTEC student, regardless of whether they have taken CPVE or not). Profiles and records will help college staff in constructing individualised courses and `top ups', as will the use of conventional in-course assessments (eg. City and Guilds skills tests).

CPVE preparatory modules, where taken, tend to be seen as a `preparation' for Level 1 BTEC work, leading into a range of related BTEC units with minimal overlap. At present, they would provide a route into BTEC Level 1 work for students who did not have the necessary attainment levels in school exams to qualify for direct entry. (The position may become more complex, however, with the planned introduction of the BTEC First Award, which will be available for roughly the same type of trainee, though assuming a higher level of vocational commitment).

It appears, however, that the CPVE Joint Board is concerned that progression into BTEC should be dependant not only on the vocational studies elements of CPVE, but also on `core' achievements.

At present two external assessments have been developed for use within the communications and numeracy cores. Eventually assessments will be available within all ten core areas, which will help to formalise the progression routes.

Bridging Implications

As with progression from CPVE into occupational training, developments within this bridge are at an early stage. National discussions are taking place to establish more formal equivalencies between each of the CPVE `strands' and full-time BTEC courses and units. In the interim, colleges are working out their own routes and where necessary constructing individual bridges to match students' needs.

B6: CPVE* BTEC DIPLOMA AND CERTIFICATE IN ENGINEERING

LIKELY ENGINEERING-RELATED EXPERIENCES WITHIN CPVE	LIKELY CONTENT OF 'BRIDGE' REQUIRED TO ENTER BTEC DIPLOMA AND CERTIFICATE
CPVE 'core' Work experiences in engineering Project work (possibly based on City and Guilds) Preparatory Modules - based on - CPVE Modules - BTEC - City and Guilds	Negotiated on local basis taking into account previous attainments

ISSUES

1. Developments in National guidelines/local agreements
2. Development of range of 'CPVE' modules - 'First Award'
3. Possible development of progression through 'core' attainments

* The CPVE student is assumed to have 'some' level of vocational commitment to Engineering

PROGRESSION INTO ENGINEERING

Overview Conclusions

Having discussed the constraints and considerations which have affected and to some extent shaped the research it is necessary to address the main questions posed in the original research brief.

Is there a need for more formal bridging arrangements?

More systematic progression routes, which may involve bridging, is needed where:

1. There is `overlap' between the provision of different institutions for which no credit is given.

2. No provision is made for assessing skills acquired on-the-job or in work experience.

3. Age barriers disadvantage individuals who have not followed established routes.

Is bridging possible to meet these requirements?

Bridging arrangements could often be made more effective, though no single approach is likely to be effective on its own. Consideration must be given to at least three methods:

1. Establishing workable systems of crediting skills achieved.

2. Establishing reliable means of assessing skills achieved.

3. Providing `top up' materials as required.

Can Engineering-Based Modules be Devised to Bridge Students or Trainees into Engineering Training?
What Alternative Mechanisms might Facilitate Progression?

Before engineering-based modules can be devised, previous relevant experience must be established.

This can be done in several ways:

1. informally, in interviews or discussions
2. using written summative profiles or records of achievement
3. using formal testing and assessment (may include practical skills tests)

2. Profiles and records of achievement - can record attainments either in detail (including standards of competence, such as engineering tolerance levels) or more broadly. Many such records or profiles are already used within TVEI, CPVE and YTS eg. the CPVE preparatory module checklists and many locally devised frameworks.

3. Testing and assessment programmes - can be constructed using whatever training criteria are considered appropriate. Many practical engineering skills and testing mechanisms already exist eg. the EITB Craft Programme checklist. Information gained in interviews and profiles can help to focus more formal testing programmes of this sort.

If students/trainees all follow similar programmes to a similar level, local efforts can be made to ensure compatability between the programme content and subsequent provision.

Standardisation top up modules can then be devised for groups of trainees with similar experiences to link with specific courses or programmes.

This might take place at a local or national level. At a local level efforts can be made to familiarise employers with local initiatives who can adjust industrial training programmes to reflect them. At a national level, exemptions can be formalised between any programmes which have wide currency in the industry. This could be done following the introduction of any major new programme: **An example is City and Guilds 201 which should have a consistent overlap pattern with many EITB Programmes though the full extent of the overlap commonly emerge over time.**

How Could the Modules or Mechanisms Work in Practice?

When the type and extent of previous experience is established, different sorts of bridging modules or mechanisms may be appropriate. As all YTS Engineering, most TVEI and CPVE schemes and some YTS General schemes will include some relevant skills experience and knowledge, the exact extent of which will vary from trainee to trainee, individualised modules or programmes may need to be constructed to `top up' trainees to a point where they can match established training criteria.

In order to implement any formal progression mechanism, it is necessary to have:

1. Established training criteria

   Some engineering programmes have clearly established training criteria, eg. the EITB craft programme. Others, eg. many operator and technician training programmes, are variable and often less formal. Where the training criteria of particular programmes are not standardised, bridging modules of the type outlined may either need to be highly individualised (eg. in technician training, where many programmes are already based on systematic detailed analyses of individuals' backgrounds and intended functions) or may not be appropriate (eg. in much operator training where job tasks are highly specific and previous experience is not likely to be relevant).

   However, the emergence of new technologies has made distinctions between operator, craft and technician functions less and less clear and has increased the number of new skill specialisms.

   Given this fluidity, it may be more appropriate to look at bridges leading into the industry rather than into particular programmes, and more general criteria - based on the common elements of the initial training programme - could be used.

2. Effective profiling and/or initial diagnostic testing methods which reflect the criteria

   Many systems already exist for profiling and recording achievements. However, at present there is little standardisation. To be useful for bridging purposes, summative profiles or records need: to be easy to use and understand; to specify industrially-relevant levels of competence where appropriate; and to incorporate sufficient detail to inform further focussed assessments.

   Diagnostic testing systems need to be closely related to actual training criteria.

3. Resources and time to construct profiles and conduct assessments as necessary

4. The capacity to deliver individualised training

   Training centres and staff need to be able to accommodate flexible individualised learning programmes.

Modules bridging trainees into specialist programmes would normally only be appropriate after recruitment to the programme and prior to initial training, in line with employer specifications.

Broad-based engineering programmes could however be provided within TVEI, CPVE or YTS schemes and also within initial training prior to specialisation.

COST IMPLICATIONS

In assessing the attainments of individual students prior to designing an appropriate programme of bridging modules, there are two possible approaches:

(i) profiles providing details of the skills achieved which can be measured against the vocational training programme

(ii) initial assessment or diagnostic testing

The costing of these can only be very tentative, and depends on a number of variable factors. Considering each of the alternatives separately:

1. Profiling - as this is an integral part of a number of the initiatives which progress into industrial training, the costing cannot be estimated independently, but in real terms profiling does depend on time commitment by staff involved in courses.

2. Initial assessment or diagnostic testing - the costing of this depends on a number of factors, predominantly:

(i) numbers of students involved

(ii) time taken for assessing each skill area

(iii) the salary level of the lecturer/instructor involved in the assessment

(A suggested hourly rate for a lecturer - which is estimated on the basis of replacing that lecturer by a part time equivalent - is approximately £12 per hour.)

Weighed against the cost of this initial assessment is, however, the saving represented by the potential reduction in initial training time, which for some TVEI, CPVE and many YTS Engineering trainees could be substantial.

EXAMPLE OF COST IMPLICATIONS
(This can only be seen as a rough guide)

201 BASIC ENGINEERING COMPETENCES

PRE ENTRY DIAGNOSTIC TESTING

The nature of City & Guilds 201 Basic Engineering Competences, and the learning approach it embraces enables the student to follow a personal route to achieving certification without the need for relearning areas which diagnostic testing has identified as having been achieved.

It is necessary for diagnostic testing to evaluate all areas of competence. The City and Guilds of London Institute define competence as "that mix of skill, know how, attitude and experience necessary to performance of a real life role". In support of the competences described in the syllabus the C.G.L.I. National Advisory Committees recommend also competences in:-

"determining the task"
"planning the task"
"undertaking the task"
"checking the outcome against the specification"
(These being referred to as key competences)

It is envisaged that the tests will identify areas of strength and weakness and so form a basis on which personal course programme may be designed.

In order that the testing form a realistic element of induction not only must it be shown to be appropriate (and validated as such) but it must be economically viable in terms of both cost and time.

The following indicates the points initially identified as necessary for investigation:-

(a) Automatic credit via recognised profiles/examination results/experience.

(b) Competence areas to test, e.g. knowledge, comprehension and application.

(c) Costs of testing, e.g. time scale, student staff ratios.

(d) Resources/Facilities necessary for testing.

(e) Currency of existing tests, e.g. Bennett Mechanical Comprehension test and AH4

Initial thoughts indicate that it is necessary to investigate the following testing methods:-

(a) multi choice questions

(b) short answer questions

(c) practical exercises

(d) problem solving exercises.

Example of costing

The illustration makes the following assumptions:

a. Test restricted to 10 Core areas only

b. Full cost calculations made using existing local format

c. Student/Staff ratio 5:1

d. Calculations made on 2 x 6hour days - possible test duration

Costing per 5 'students'

cost factors	grade 4	grade 5
(1) Staff 12 hours x grade/hour	150 - 84	108 - 60
(2) Salary overheads ie 15% of above	22 - 63	16 - 29
(3) Technician support @ £2.00 /hour	24 - 00	24 - 00
(4) LEA Overheads ie 30% of (1) + (3)	52 - 45	39 - 78
(5) BSA & E	15 - 00	15 - 00
Therefore Department cost = TOTAL	264 - 92	203 - 67
(6) Full Cost Dept % @ 15% of above total	39 - 74	30 - 55
Sub Total	304 - 66	234 - 22
(7) Profit margin @ 30% of sub total	91 - 40	70 - 27
TOTAL Cost per 5 students	396 - 06	304 - 49
Cost per 1 student	79 - 21	60 - 90

PLEASE NOTE. The above costing is only an example showing areas to be included. Further Education rates would be considerably cheaper.

Other additional costs may include:

Travel

Hospitality

Use of facilities.

RECOMMENDATIONS

A. Module or Course Content

1. Initial Engineering Courses

Modules or courses which form an introduction to engineering, and which could provide the basis for later specialisation, could play a vital role in creating a realistic picture of the industry and the skills involved in engineering. It is recommended that such courses contain the following components:

- basic knowledge of the industry
- familiarity with tools, machines and materials
- basic practical engineering skills to stated levels of competence
- technical communication skills and familiarity with technical symbols
- basic measurement skills
- industry-wide safety procedures

2. These modules could be used eg.:

- within TVEI pre- or post-16
- as an introductory module within CPVE
- as an off-the-job YTS Engineering alternative
- as the broadly-based initial training component of industrial programmes to complement specialised skills training (specifically relevant in many operator schemes).
- to top up students or trainees with little previous experience at any point.

Alternatively a set of baseline attainment levels compatible with these components could be used to measure skills and attainments, however gained. This would be particularly relevant within YTS and occupational training, where work-based learning and opportunities for off-the-job learning are combined.

3. Industry's Input into Courses

Continued efforts should be made to increase school-industry liaison. Industry should be encouraged to make an input into school courses to give the industrial perspective. Employers' involvement in the development of profiles and records of achievement will ensure these records will be of direct relevance to industry's needs when recruiting.

B. Assessment and Profiling

1. All types of courses, whether conducted within a TVEI, CPVE or YTS framework should provide the student with a profile or record of achievement, including where appropriate reference to specific engineering skills. Work experience periods should be closely monitored and appropriate records

kept. It is particularly important that profiles and records are readily understandable to all parties within the education and training process, and that they are used when the student/trainee transfers from one institution to another.

2. Guidance may need to be given to students/trainees and staff in schools, colleges and training schemes to ensure that records are kept and used appropriately.

3. Relevant initial assessments should always be conducted on entry to an engineering training centre. Where records and profiles are available, these may be used to focus the assessment programme.

C. Progression

1. Mechanisms are necessary to support liaison between FE colleges, schools and employers on a local basis, particularly to ensure smooth transition between school and work or college courses. The creation of progression working groups might help to facilitate the development of clear progression routes and prevent `overlap'.

2. Industry should be encouraged to recruit school leavers regardless of age, despite former practices of recruiting only at 16, to accommodate the increasing numbers of students following prevocational courses such as TVEI and CPVE at 16+.

D. Publicity

1. The introduction of new initiatives in education and training should be accompanied by an extensive publicity campaign.

2. Engineering often has a poor image among young people as a career destination. Industrial and engineering staff could help to improve its image by becoming actively involved in schools.

APPENDIXES

APPENDIX 1 INFORMATION SHEET DESCRIBING RESEARCH

TRAINING FOR ENGINEERING

BACKGROUND INFORMATION ON THE MSC PROJECT 'AN EXPLORATION OF BRIDGING MODULES IN ENGINEERING' - UNDERTAKEN AT THE UNIVERSITY OF SURREY

Young people are now entering the engineering industry with a wider range of educational and training backgrounds than ever before. For many, their first experience of engineering will be on a Youth Training Scheme or in an apprenticeship; many will have had their awareness of technology raised whilst at school; and some may have had direct experience of engineering through their school courses. New developments in education such as the Technical and Vocational Education Initiative - TVEI - and the Certificate of Prevocational Education - CPVE - are specifically aimed at relating school studies to the 'world of work', and developing skills which are directly applicable to the pupils future careers. Courses within both these new initiatives will provide experience in engineering.

The Manpower Services Commission (MSC) is carefully monitoring new educational and training initiatives to make sure that, whichever route young people choose to take, when they eventually enter the industry as trained craftsmen and women or technicians, they will have the knowledge and skills they need to do their jobs effectively and to continue to learn and to progress within their chosen field.

A research team at the University of Surrey, working on behalf of the MSC, is therefore looking at what the different routes mean in practice - the team's particular brief being to identify any gaps in training which may result from taking any one of the routes or options, and to put together outlines for 'bridging modules' - additional training or education which will 'bridge' students from one course to another - to ensure that all individuals have the opportunity to progress within the industry, whatever their starting point.

The research is being approached in a number of ways:

1. policy level - meetings with senior officers of examining and training bodies

2. schemes and courses in action - examples of each to give a variety of interpretation

3. employers - discussing recruitment and practices at the 'grass roots'

4. case studies - five areas (Reading, Poole, Bedford, Wirral and Fife) have been chosen to provide examples of significant attempts to coordinate initiatives and provide programme routes

The Project's conclusion will be presented to the Manpower Services Commission at the end of 1986.

The project team, Jan Shepherd and Veda Dovaston, is currently interviewing a range of people involved in education and training within Engineering, and your cooperation would be very much appreciated. If you would like more information, or have any questions about the research, they can be contacted at the University of Surrey on Guildford (0483) 571281 Ext. 3123.

APPENDIX 2 STRUCTURED INTERVIEWS USED IN THE RESEARCH

BRIDGING MODULES

Interviews with FE Lecturers

1. Role of the College in Engineering training?
   eg. is it the managing agent.

2. What engineering courses are run for 1st year students?

3. Sources of students

   - types of employers size/type of engineering

4. What types of employment are there in the area and unemployment level? What is the likelihood of employment for students in engineering?

5. What is the selection process/criteria used and by whom?

6. What details do you have on students?

7. What further information do you seek?

8. Contacts with:

   - schools

   - employers

   - training centres

9. How useful have school courses eg. CSE or OL Technology or CDT been in their training?

10. What is your experience of:

   - TVEI

   - CPVE

11. Have any of your students followed these courses and how appropriate have they been?

12. Have any exemptions been given or do you see any possibilities for exemptions?

13. How have the e exemptions been organised?
    How have exemptions affected their training?

   - time

   - level

14. What are the progression routes from 1st year?
    Drop out rates?
    Employment?

BRIDGING MODULES

Interviews with Instructors

1. What courses are run at centre?

   - and what other complementary courses are trainees following?

2. Sources of trainees:

   - types of employers size/type of engineering

3. What are the main types of employment in the area? And what is the likelihood of employment for students in engineering?

4. What is the selection process/criteria used and by whom?

5. What details do you have on trainees?

6. What further information do you seek?

7. Contacts with schools/colleges?

8. How useful have school courses eg. CSE or OL Technology or CDT been in their training?

9. What is your experience of:

   - TVEI

   - CPVE

10. Have any of your trainees followed these courses and how appropriate have they been?

11. Have any exemptions been given or do you see any possibilities for exemptions?

12. How have these exemptions been dealt with?

13. How have exemptions affected their training:

   - time

   - level

14. What are the destinations of trainees including 'drop out' and reasons for it?

BRIDGING MODULES

Interviews with Students

1. Which course are you taking?

2. How did you hear of the course?

3. Were you - interviewed

   - tested

4. What relevant courses did you follow in school?

   - OL/CSE
   - TVEI
   - CPVE

5. How valuable are they in what you are now doing?

6. Were you asked about previous course when you first came here?

7. Were allowances made for your experience eg. exemption from part of the course?

8. How has your previous experience affected your course eg. have you moved through it faster than your peers?

9. What have you learnt on the course?

10. What are your future plans?

Changing Employment Patterns

Fig. A **Changes in Occupation 1971-1981**

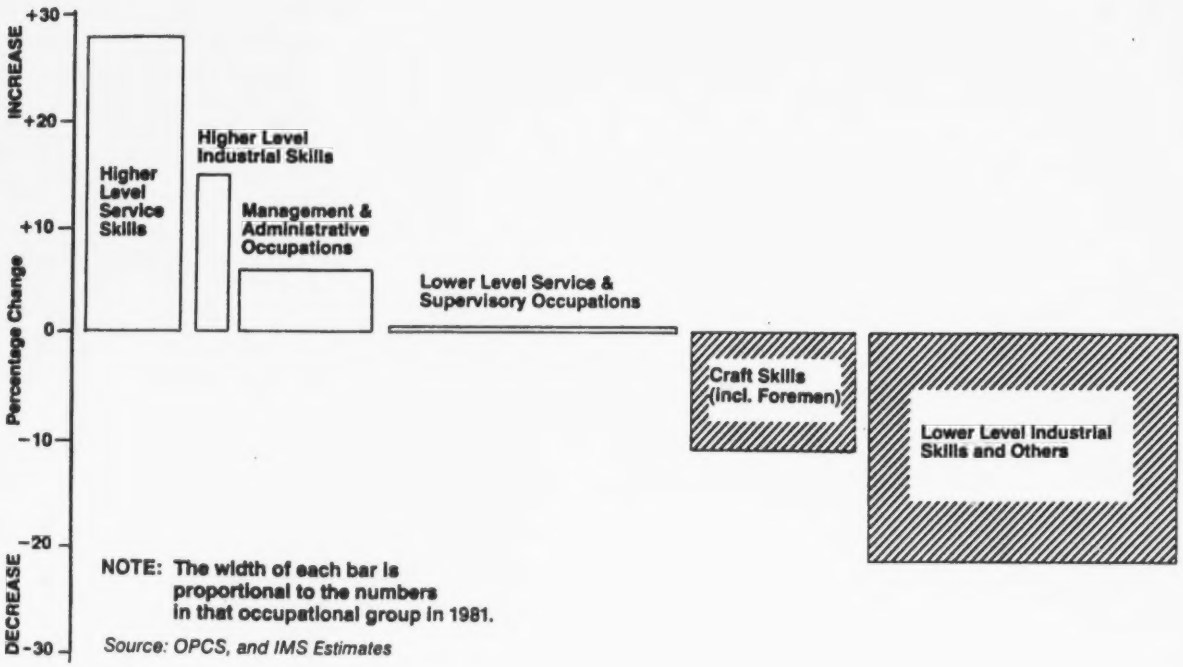
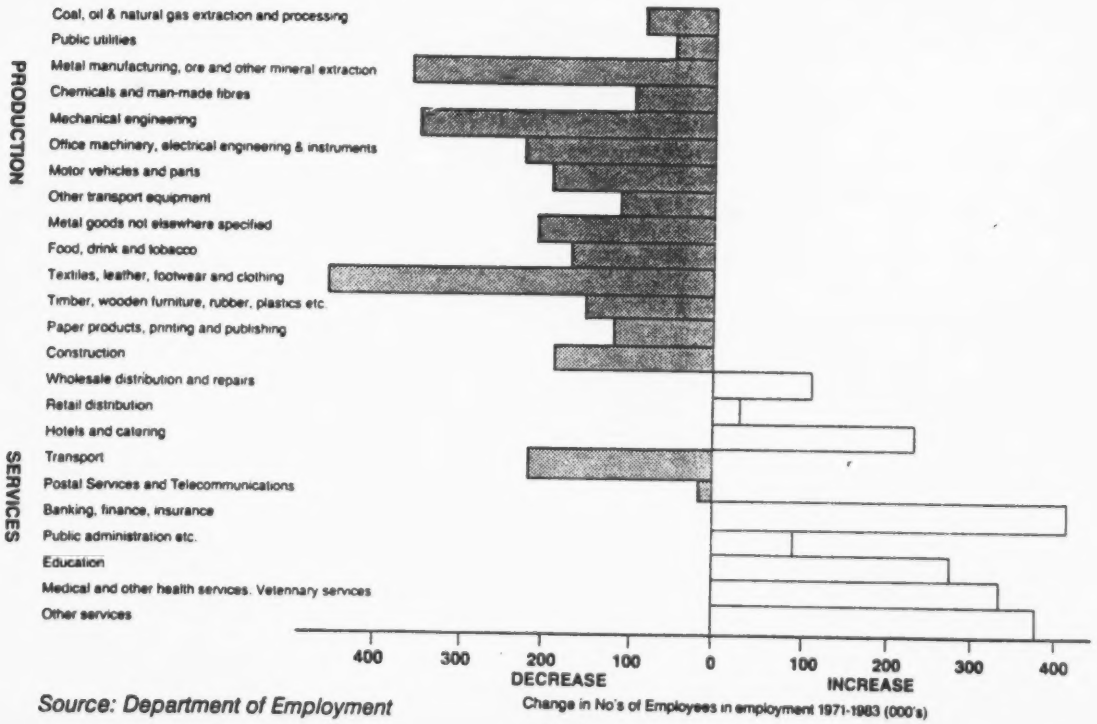


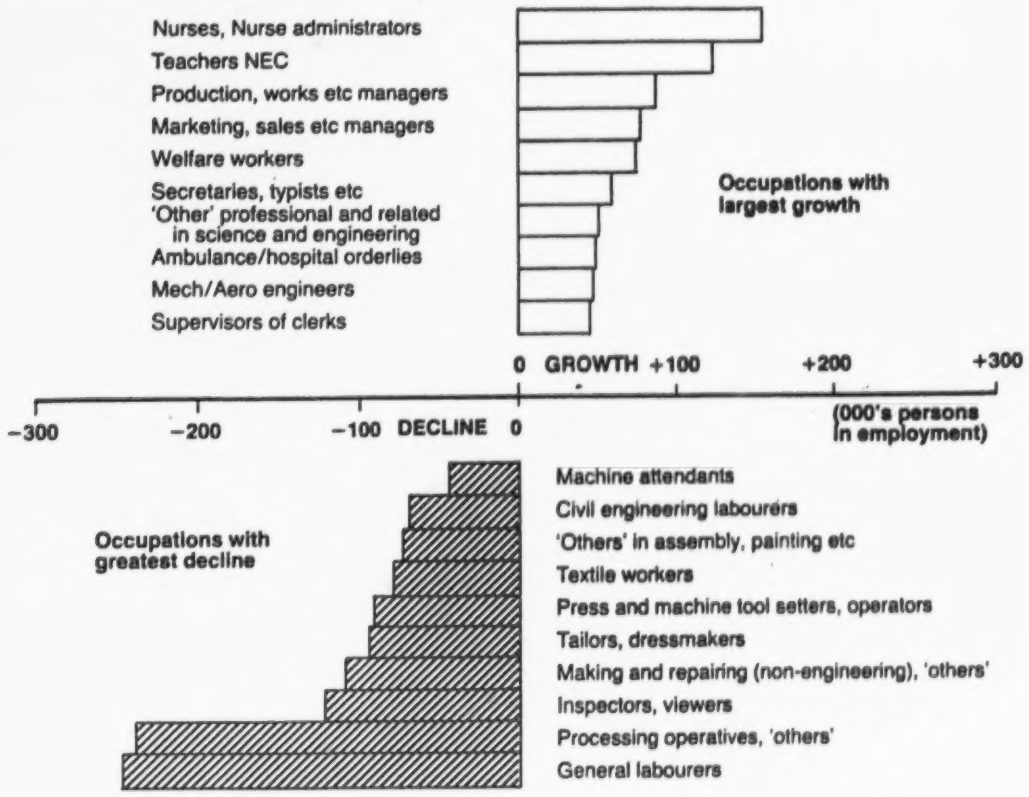
Fig. B **Employment Change in Services and Production Industries 1971-1983**



Source: Department of Employment

Fig. C

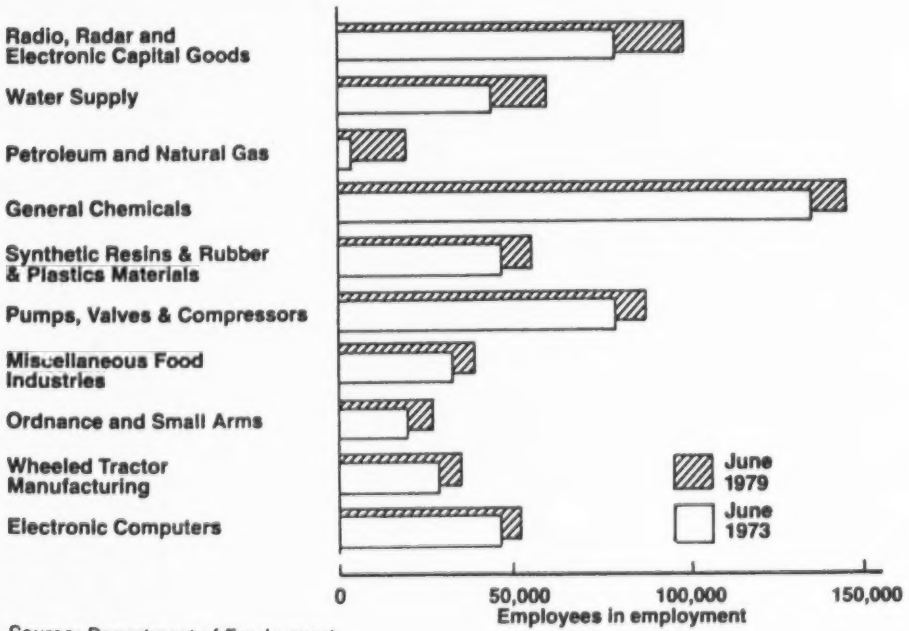
Occupations with Greatest Growth and Decline, 1971 – 1981



Source: OPCS (England and Wales)

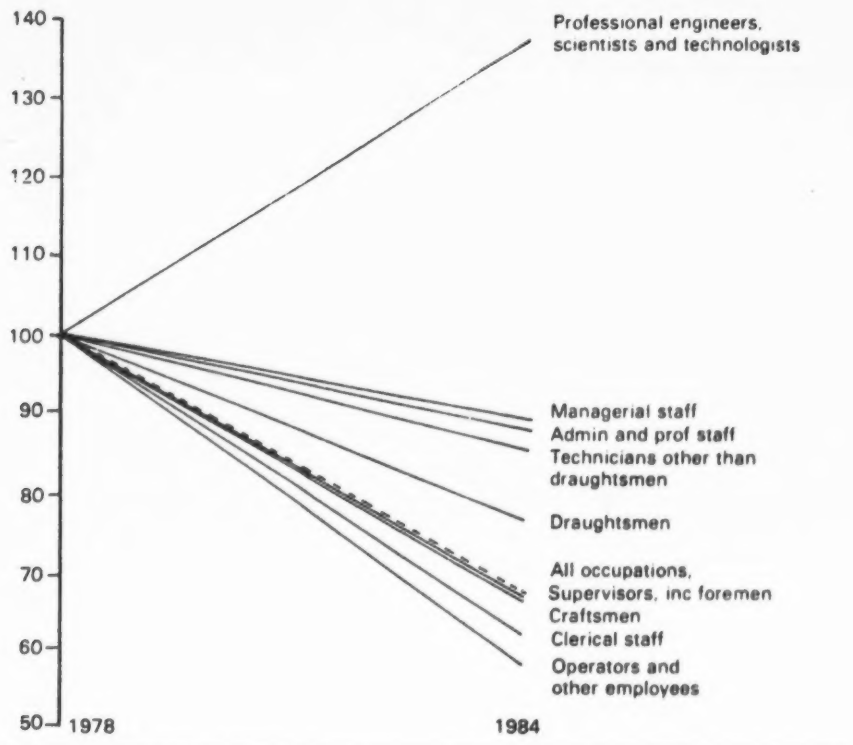
Fig. D

Production Industries with highest growth in employment, 1973-1979



Source: Department of Employment

Fig. E The change in employment in each occupational group in the engineering industry between 1978 and 1984. (1978 = 100)



Source: EITB statutory returns and derived from Department of Employment L7A survey and EITB L7A/S1A surveys

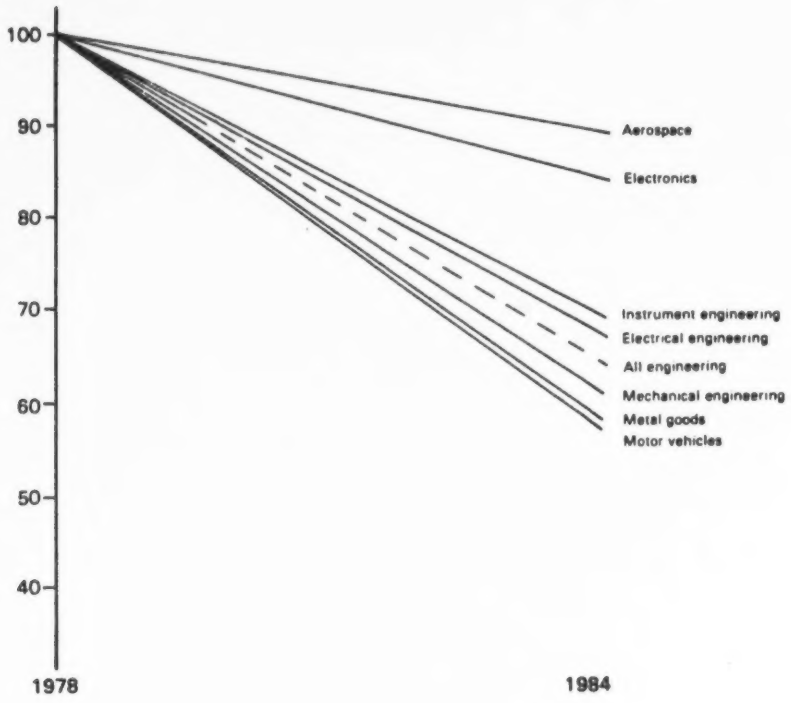
Table (1) Employment by occupation in all engineering, 1978 and 1984

Occupational category	Number		Percentage		Percentage change 1978 to 1984
	1978	1984	1978	1984	
(1)	(2)	(3)	(4)	(5)	(6)
Managerial staff	138 118	122 185	4.5	6.0	-11.5
Scientists and technologists	58 708	80 430	1.9	4.0	+37.0
Technicians including draughtsmen	215 173	179 751	7.0	8.9	-16.5
Administrative and professional staff	149 882	132 103	4.9	6.5	-11.9
Clerks, office machine operators, secretaries and typists	341 106	209 437	11.2	10.3	-38.6
Supervisors including foremen	150 534	99 389	4.9	4.9	-34.0
Craftsmen	553 305	365 145	18.1	18.0	-34.0
Operators and other employees	1 451 857	835 673	47.5	41.4	-42.4
Total	3 058 683	2 024 113	100.0	100.0	-33.8

Source: EITB statutory returns

Fig. F

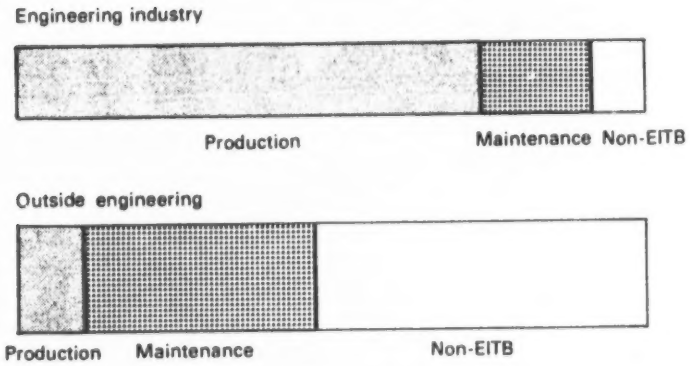
Index of employment for the main sectors of the engineering industry, 1978 and 1984 (1978 = 100)



Source: EITB statutory returns

Fig. G

Engineering craftsmen inside and outside the engineering industry



Source: New Earnings Survey 1980

Fig. H **Trends in Apprenticeships – Selected Industries, 1970/71 to 1982/83**

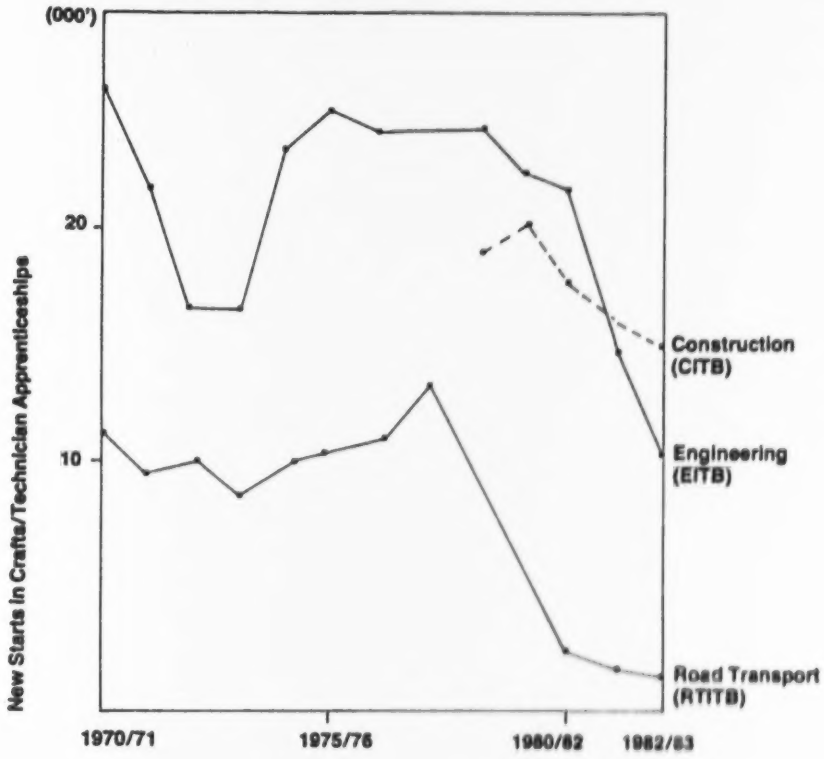
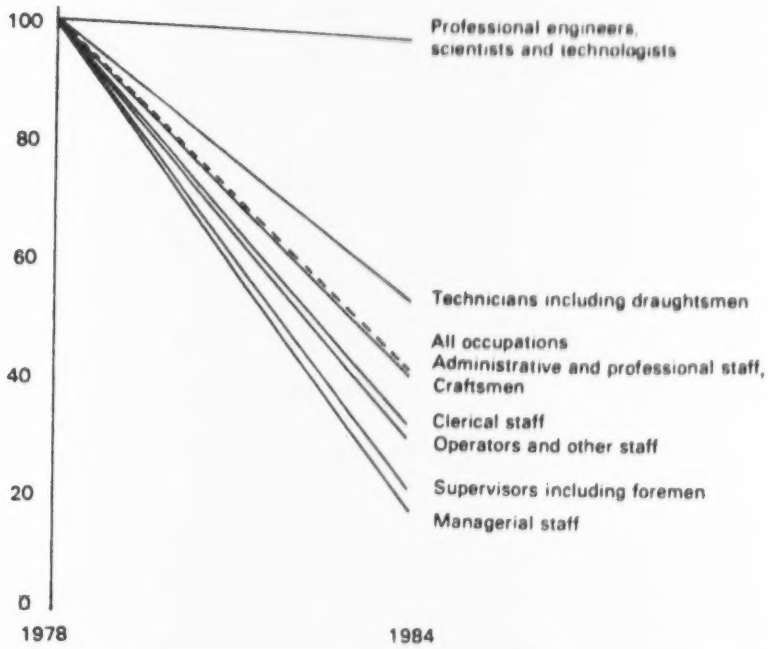
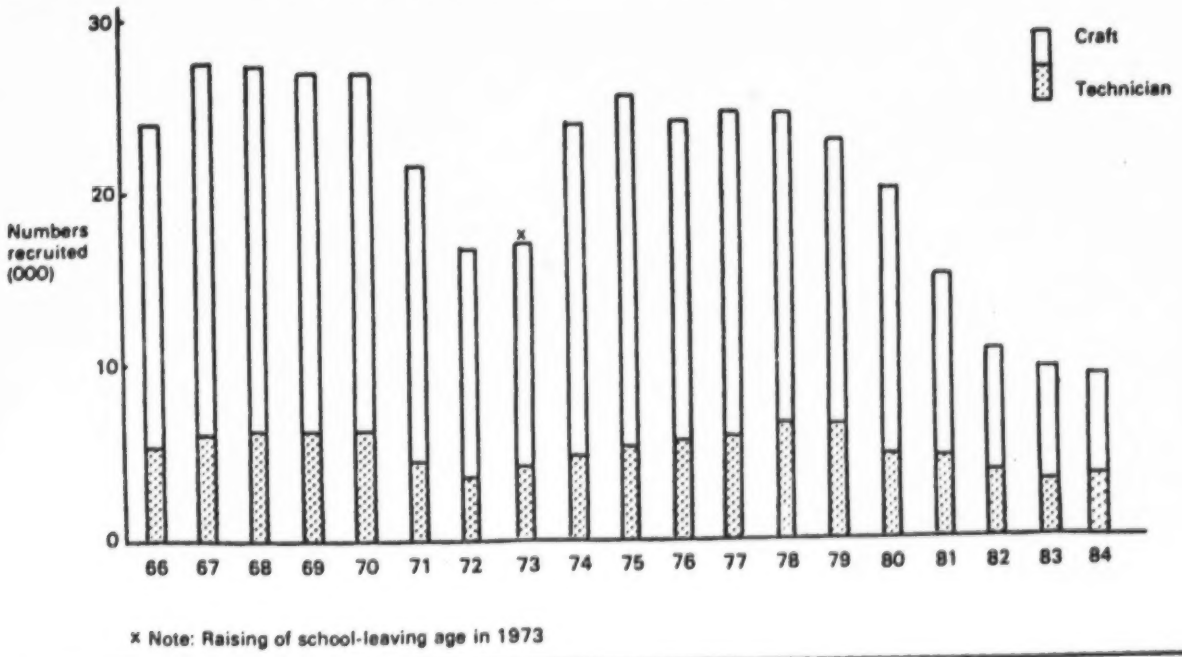


Fig. J The change in the number of trainees, by occupation, 1978 to 1984 (1978 = 100)



Source: EITB grant claim forms and L7A/S1A form

Fig. k. Recruitment of first year craft and technician trainees into engineering, 1966 to 1984



Source: EITB records

Note: 1983 and 1984 numbers include YTS trainees following EITB approved basic training

TABLE (2)

Number of first-year craft and technician trainees registered, analysed by location of training, 1966/67 to 1984/85

Year	Location of training				
	Industry	College	Group centres and Board centres	Others including skill centres	Total
(1)	(2)	(3)	(4)	(5)	(6)
1966/67	16452	6328	500	700	23980
1967/68	18044	7610	1500	385	27539
1968/69	17515	7214	2150	411	27290
1969/70	16213	7275	2609	455	26552
1970/71	16276	7338	2945	30	26589
1971/72	11598	6904	3422	18	21942
1972/73	9507	4811	2452	18	16788
1973/74	10213	4282	2385	40	16920
1974/75	12875	6967	3619	35	23496
1975/76	12631	8840	3750	22	25243
1976/77	11873	8388	3946	42	24249
1977/78	11918	8568	4114	43	24643
1978/79	11916	8136	4454	26	24532
1979/80	11344	7343	4118	17	22822
1980/81	10059	6223	3828	27	20133
1981/82	7240	4670	3060	50	15020
1982/83	5666	3055	2163	24	10908
1983/84	5098	2166	2448	12	9724
1984/85 (see note 4)	3076	1260	1700	6	6042
Numbers financed by Award Scheme, included above (see notes 2 and 3)					
1971/72	140	1748	601	-	2489
1972/73	80	1067	381	-	1528
1975/76	555	2404	477	-	3436
1976/77	460	2357	784	18	3619
1977/78	332	1822	867	9	3030
1978/79	102	984	697	-	1783
1979/80	14	268	433	-	715
1980/81	104	1014	995	-	2113
1981/82	594	1841	1390	-	3825
1982/83	390	923	722	2	2037
1983/84	128	330	779	2	1239
1984/85	5	48	13	-	66

Notes

1 The breakdown of the total by location for 1966/67 is partly estimated

2 The Board and the Department of Employment, acting jointly, sponsored schemes to recruit additional school-leavers to augment the intakes for 1971/72, 1972/73 and 1975/76 to 1983/84

3 From 1976/77 there were two schemes

a) trainees taken on the Board's payroll as in the earlier years, these are included with those financed by the Award Sceme

b) trainees employed by firms as 'extra' to their own requirements, who are not counted as Award holders

4 The above figures do not include trainees following the new course for Technician Basic Training. In 1984/85 there were some 2000 such trainees

TABLE (3)

Craft and technician trainees: certification of first-year trainees, by year of commencement of training, 1969/70 to 1984/85

Year training commenced	Received EITB first-year certificate	Did not receive EITB first-year certificate	Still under training	Total first-year registrations
(1)	(2)	(3)	(4)	(5)
1969/70	24475	2493	-	26968
1970/71	24191	2569	-	26760
1971/72	19666	1873	-	21539
1972/73	15290	1372	-	16662
1973/74	15848	1165	-	17013
1974/75	21910	1868	-	23778
1975/76	23653	1896	-	25549
1976/77	22384	1612	-	23996
1977/78	22796	1718	-	24514
1978/79	22904	1616	-	24520
1979/80	21502	1250	-	22752
1980/81	19133	927	-	20060
1981/82	14186	745	-	14931
1982/83	10404	471	7	10882
1983/84	9194	478	72	9744
1984/85 see notes 4 &5	6042	-	-	6042

Notes

1 Trainees are included in this table if the last company at which they were training was in scope to the Board. Over recent years a considerable number of trainees have been made redundant. Many of these trainees have had their training continued by other in-scope companies - these trainees are included above.
Other redundant trainees have continued their training with out-of-scope organisations - these trainees are *not* included above.

2 For 1984/85 there were a further 1188 trainees registered through out-of-scope organisations by March 1986: though experience indicates that final figures are likely to be higher.

3 Figures for *all* years are liable to amendment as some training is reported late.

4 From 1984/85 new arrangements have been introduced for registration. As a consequence only trainees who receive a certificate are reported.

5 In 1984/85 there were also some 2000 trainees following the new arrangements for Technician Basic Training they are *not* included above, as it is not possible to identify the start date for the trainees.

APPENDIX 4 Written Guidance on Topics of Interest to the Research, as given to key individuals invited to comment.

TOPICS IN THE INDUSTRIAL CONTEXT ON WHICH VIEWS ARE SOUGHT

Industrial:

Skill shortages.
Skill needs.
Recruitment policy - industry's view of how schools should be preparing pupils for employment in engineering.
Industry's view of developing school-industry links.
The value to industry of school reporting procedures and profiles.
The industrial perspective on TVEI and/or CPVE.
The value of school GCE and CSE courses to a career in engineering.

TOPICS IN THE COLLEGE CONTEXT ON WHICH VIEWS ARE SOUGHT

College:

The value of school reports and profiles etc.
The value of GCE and CSE and other school courses.
The value of school-based TVEI to Engineering courses.
CPVE in engineering.
School-college links.
The impact of YTS on colleges - curriculum and organisational issues.

TOPICS IN THE SCHOOL CONTEXT ON WHICH VIEWS ARE SOUGHT

Schools:

How schools see GCE and CSE Technology as a preparation for careers in Engineering.
The development of GCSE in technology-based subjects.
The development of TVEI and CPVE and their role in preparing students for careers in engineering.

TOPICS RELATING TO NATIONAL BODIES ON WHICH VIEWS ARE SOUGHT

National bodies:

EITB and developments in their training policy.
NCVQ and its role in facilitating progression.
CPVE within BTEC provision.
TVEI and BTEC.
TVEI and CGLI.
The development and piloting of CGLI 201.

EITB
Engineering Industry
Training Board
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Training in INDUSTRY YEAR 1986

YOUR REF

OUR REF [TSE3.5]

17 October 1986

Miss J Shepherd
Senior Research Officer
Department of Educational Studies
University of Surrey
Guildford
Surrey GU2 5XH

Dear Jan

AN EXPLORATION OF BRIDGING MODULES IN ENGINEERING

I have now had the opportunity to examine the possibility of bridging modules in the 8 areas we discussed.

Please note that I have only considered bridging into the EITB Craft training system i.e. Basic Engineering Training Parts 1/2 and 3 and segments. Further examination will be necessary for Technician training or any other relevant areas.

1. A.E.B. Craft Design - No comparison was possible. This syllabus does not involve achievement of practical skills to defined standards.

2. A.E.B. Control Technology - Not acquisition of practical skill.

3. CSE Craft Design & Technology - Drilling Machine
Forge work
Sheet metal
Foundry
Turning
Materials

These are all relevant practical skills.
In order to be able to identify suitable bridging modules we would need to know:-

1. The standard worked to and the Instructional Objective for the specific skill.

Thanks to INDUSTRY

2. Did the trainee actually achieve the individual skill (e.g. the syllabus shows soft-soldering but the system does not appear to require that a particular trainee has achieved or failed in that particular skill.

4. CSE Scientific & Technical Studies - Objectives are put in terms of 'Describe' 'Explain' 'Identify'. This is Further Education or Job Knowledge rather than Practical Skill training. It is complementary to B.E.T. and Segments. We are not considering acquisition of practical skill.

5. GCSE Engineering Workshop Theory and Practice - Here a precise bridging module can readily be prepared.
Aspects of Measuring - Marking
Turning
Milling & Bench Fitting
can be compared Skill by Skill as shown (see Part 1 & 2 attached).

A bridging module into BET Part 3 would comprise those skills not exempted (no tick in column D).

NOTE: This is on the assumption that the trainee has achieved all the skills set and a short assessment may be necessary on entry into B.E.T.

6. GCSE Graphic & Technical Communication - This would clearly give exemption from Part 1 or 2 Drawing.

7. A.E.B. Engineering Science - Practical skill content 4% ... no comparison with BET is possible. Part 2 may be more relevant but the comments made under 3. CSE will apply.

8. CPVE Part C - Some of these will exempt trainees from parts of Craft training e.g. 9. Engineering Drawing will adequately cover all aspects of Drawing in BET Parts 1 & 2 and Core Segments.16, 17 & 22 are also very relevant.

No bridging module would appear to be possible or necessary as skills are not given standards and achievement of skills may or may not take place. As trainees are keeping 'Self Assessment' profiles, these could readily be used to assess individuals against the BET Specifications and individual bridging modules prepared for entry into BET or Segments.

I hope these comments and suggestions are useful and will be glad to discuss them further as necessary. I have now passed the documentation over to John Stroud who will no doubt be contacting you in due course.

Yours sincerely

Dennis White
Senior Training Adviser

EITB Engineering Industry Training Board

Skill and Training Specification
BASIC ENGINEERING TRAINING
Parts 1 & 2
TRAINEE'S NAME

Basic Engineering Training

Parts 1 & 2 - Broad Based Foundation Training

Skill Specification
This Skill Specification defines the range of skills and standards which should be achieved during this stage of Basic Engineering Training.
Trainees should be capable of:

1 The safe use and application of a range of machine tools, hand tools and ancillary equipment necessary to carry out the skills listed in the Training Specification.

2 Reading and working to engineering drawings to BS 308 (1984) Parts 1 and 2 (Engineering Drawing Practice).

3 Using measuring and marking out equipment as outlined in the Training Specification in:

(a) metric units
(b) imperial units.

4 Selecting and using appropriate cutting fluids and lubricants.

5 The application of workholding techniques and the correct methods for the basic practices appropriate to producing workpieces by milling and turning.

6 Using basic bench-fitting techniques to carry out simple operations as listed in the Training Specification.

7 The application of basic tools and equipment for the cutting and forming of thin plate material.

8 The application of basic cutting and welding practices by the oxy-acetylene and manual metal-arc processes.

9 Understanding the basic principles of electrical/electronic practices; and identifying, mounting and connecting simple electrical and electronic components.

10 Achieving dimensional accuracy and surface texture in an economical time to at least the following standards:

	Part 1	Part 2	
Operation	Tolerance	Tolerance	Surface Texture
Bench Fitting	±0.4mm ±0.016ins	±0.25mm ±0.010ins	1.6µm 63µins
Machining	±0.4mm ±0.016ins	±0.25mm ±0.010ins	1.6µm 63µins
Marking out	±0.5mm ±0.020ins	±0.4mm ±0.016ins	
Bending/forming sheet metal	±2.0mm ±0.080ins	±1.5mm ±0.060ins	

FYS 1

TRAINING SPECIFICATION

This Training Specification specifies the training which should be undertaken during the broadly-based training period (Parts 1 & 2 of Basic Engineering Training which will normally occupy about 16 weeks).

Note: Trainees who have undertaken practical engineering subjects prior to entering a Basic Engineering Training programme may be allowed exemption in specific areas of training.

The boxes provided on the right-hand side of each page are to allow a record to be kept of your training:
Column A is for recording practices of skills in Part 1 of the programme.

Column B is for recording practices of skills in Part 2 of the programme (some of these will represent further practice of Part 1 skills).

Column C is for indicating that Part 2 skills in Column B have been achieved to the standard stated for Part 2 (see Skill Specification).

Column D is for recording practices carried out prior to the commencement of Basic Engineering Training which may exempt the trainee from further practice in that skill area during Part 2.

The index numbers in the left-hand column relate to specific instructional objectives. These instructional objectives are being prepared by the Board to assist in programme preparation and will contain the safety aspects and related job knowledge necessary to ensure that an acceptable standard of performance is attained by the trainee.

SAFETY

Instructional Objective index number

The trainee must be given induction and safety training in all skill areas which form part of the programme irrespective of any previous training.

The trainee must have an understanding of the Workshop Statutory Requirements with regard to:

(a) Statutory requirements

S1	The Health and Safety at Work etc Act 1974	
	The Factories Act 1961	
	The Protection of Eyes Regulations 1974	
	The Electricity (Factories Act) Special Regulations, 1908 and 1944	
	The Abrasive Wheel Regulations 1970	

(b) Workshop requirements

S2	First aid procedures	
	Accident procedures	
	Fire hazards and fire fighting procedure	

(c) Personal protection

S3	Protective clothing	
	Manual lifting techniques	
	Personal hygiene	

Engineering Drawing

			A	B	C	D
ED1	Understanding the basic drawing conventions and symbols to British Standard Specification BS308	Dimensions				
		Abbreviations				
		Manufacturing tolerances				
		Surface texture				
	Understanding simple orthographic drawings	1st angle projection				
		3rd angle projection				
	Making simple isometric sketches from	Objects				
		Orthographic drawings				
	Understanding sectional views					
	Reading simple component drawings and extracting information correctly	Type of material required				
		Size and shape of material				
		Shape of component				
		Operations necessary				
		Dimensions and tolerances				
		Surface finish				

Measuring and marking-out

IM1	Measuring, using	Rules/tapes				
		Calipers				
		Protractor				✓
IM2	Using	Radius gauges				✓
		Feeler gauges				
IM3	Measuring, using	External micrometers				✓
IM4	Measuring, using	Vernier calipers				✓
IM5	Checking machined surfaces using	surface texture plates				
M01	Marking out, using	Rules				
		Centre punch/scriber				
		Dividers				
		Scribing block				
		Squares				
		Protractor				
		Surface table/plate				
M02	Marking out	Datums/guidelines				
		Angles				
		Radii/circles				
		Hole positions				

Turning

			A	B	C	D
T1	Identifying and safely using machine controls					
T2	Selecting, setting and using cutting tools					
T3	Selecting and setting speeds/feeds					✓
T4	Selecting and using coolants					✓
T5	Mounting and using	3 jaw chucks				✓
		4 jaw chucks				✓
		Driving plate and centres				✓
T6	Facing	To the centre of the work				
		A shoulder				
		To length				
T7	Turning diameters	External				
		To a shoulder				
T8	Centre drilling					✓
T9	Drilling	Through workpiece				
		To a depth				
T10	Reaming					
T11	Knurling					✓
T12	Taper turning using compound slide					✓
T13	Thread cutting using	Taps				
		Dies				
T14	Boring	Through workpiece				

Milling using Vertical or Horizontal Machines

M1	Identifying and safely using machine controls					✓
M2	Selecting and mounting cutters	On arbors				✓
		In collet chucks				
M3	Selecting and setting	Speeds				✓
		Feeds				✓
M4	Selecting and using coolants					✓
M5	Positioning and securing	Vice to machine table				✓
		Workpiece in vice				✓
M6	Positioning workpiece to cutter using	Machined faces				
		Marking out				
M7	Milling faces	Horizontal				
M8		Vertical				
M9	Milling stepped faces					
M10	Milling slots	Open ended				
		Enclosed				
M11	Milling faces having an angular relationship	Single angle				
		Vees				

Bench-fitting

			A	B	C	D
F1	Selecting and safely using hand tools					
F2	Safely using	Drilling machines				✓
		Grinding machines (off-hand)				
		Shaping machine				
F3	Using	Cutting fluids/compounds				✓
F4	Filing surfaces	Flat and square				
		Curved				
		Angular				
F5	Removing surplus material by	Sawing				
		Chiselling				
		Shaping				✓
F6	Producing holes by	Drilling				✓
F7	Finishing holes by	Reaming				✓
F8		Counterboring				✓
		Countersinking				✓
F9	Producing threads, using	Taps				
		Dies				
F10	Fitting mating parts by	Filing				
		Scraping				
F11	Off-hand grinding centre punches and scribers					

Sheet Metal Work

SM1	Selecting and safely using hand tools					
SM2	Cutting thin plate using	Hand/bench shears				
		Guillotine				
SM3	Bending	Upstands				
		Box/tray sections				
SM4	Flanging	Boxes or cylinders				
SM5	Hemming	Single edges				
SM6	Wiring	Flat or curved edges				
SM7	Forming	Cylinders or cones				
SM8	Making a self-secured joint					
SM9	Producing holes, using	Portable drill				
		Bench/pedestal drill				
SM10	Joining, using	Mechanical fasteners				
SM11		Rivets				
SM12		Solder				

Oxy-acetylene Welding

			A	B	C	D
GW1	Safety operating oxy-acetylene welding equipment					
GW2	Producing fusion without filler					
	Depositing a straight run with filler	Flat position				
	Tack welding					
GW3	Welding in flat position	Close square tee fillet				
		Close outside corner				
		Square edge open butt				

Manual Metal-Arc Welding

AW1	Safely operating manual metal-arc welding equipment					
	Striking and breaking the arc					
AW2	Depositing a straight run					
	Tack welding					
AW3	Welding in flat position	Close square tee fillet				
		Close outside corner				

Gas or Arc Cutting

C1	Safely operating cutting equipment				
C2	Hand cutting	Straight lines, square edge			
		Straight lines, bevel edge			
		Simple shapes			

Materials

MAT 1	Identifying	Ferrous metals				
		Non-ferrous metals				
		Non-metallic materials				
MAT 2	Heat treating materials for	Hardening				
		Tempering				
		Annealing				

Electrical Wiring

			A	B	C	D
E1	Understanding basic electrical principles and safety procedures					
E2	Reading electrical drawings	Circuit diagrams				
		Wiring diagrams				
E3	Identifying and selecting cables and flexible cords					
E4	Terminating and connecting cables	Soldered terminations				
		Solderless terminations				
E5	Identifying electrical components					
	Mounting components	Correct location/orientation				
	Wiring circuits containing basic components	Plugs				
		Sockets				
		Switches				
		Fuses				
E6	Testing electrical wiring for	Continuity				
		Insulation				

Electronic Wiring and Assembly

EL1	Reading electronic drawings	Circuit diagrams				
		Wiring diagrams				
EL2	Identifying	Wires/cables				
EL3		Basic electronic components				
EL4		Component boards				
EL5		Component markings				
EL6	Mounting basic electronic components					
	Soldering basic electronic components to component boards					
	Terminating cables/wires to component boards and connectors					
EL7	Checking battery-operated circuits	Current				
		Voltage				
		Resistance				

Progression Into Engineering looks, first, at what teachers, trainers and employers can do to make sure that this experience is transferred from one stage to the next. It then sets out a framework for co-ordinating programmes which allow students and trainees to progress at their own rates and according to interest and need.

The framework both increases trainee satisfaction and enables young people to proceed more effectively into the advanced types of training made necessary by changing technology.

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